FISH AND SEAFOOD PROVISIONING: THE EXPERIENCES OF MIDLIFE ADULTS

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Stephanie Marie Bostic

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Stephanie Marie Bostic, Ph.D.

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Fish and seafood consumption is recommended as part of a healthful diet. Higher intakes, particularly of fatty fish containing omega-3 fatty acids, are associated with improved brain and cardiovascular health. Most Americans do not consume the recommended amounts of fish and seafood. To explore fish and seafood food choice, a mixed methods project with two studies was designed and conducted in rural New York State with midlife adults (ages 50-75).

The first project was an in-depth qualitative study using interviews with midlife adults (n=31). Two aspects of these interviews were examined: 1) social representations of the health effects of fish and seafood and 2) the scripts used for fish and seafood provisioning. Core and peripheral social representations were identified and described. Individual patterns of involvement with social representations were presented. Scripts used for acquiring and preparing fish and seafood as well as eating out were characterized. The importance of script integration between linked script types was suggested.

Components of the qualitative findings and other factors were then examined in a survey of midlife adults (n=212), including a sub-sample that also provided dried blood spots (n=100) for analysis of fatty acid levels. Individuals who agreed more strongly with positive social representations and who reported

greater fish preparation confidence reported higher levels of fish intake and had higher omega-3 index levels. Future research should explore these phenomena in other populations using longitudinal and experimental designs.

BIOGRAPHICAL SKETCH

Stephanie Bostic is from West Virginia. Her focus in nutrition developed out of a strong interest in food and cooking, which she has enjoyed continuing to learn about throughout her education and career. She earned her undergraduate degree from Barnard College, where she studied the influences of colonization on cuisine. She then went on to work at the Jean Mayer Human Nutrition Research Center on Aging at Tufts University while she earned a Master of Science in Agriculture, Food, and the Environment from Tufts University while discovering an interest in the experience of aging.

She caught her first fish at age four, but became a fish connoisseur while studying abroad in Japan. She is still working on becoming a skilled fish cook but has enjoyed trying the recipes shared by study volunteers and those curious about her dissertation. One particular discovery has been the tuna melt: an under appreciated classic open to novel twists. She looks forward to continuing to pursue her interest in food and cooking throughout her career in nutrition and dietetics.

This document is dedicated to everyone who has tried to cook fish and felt they failed.

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- Chair: Jeffery Sobal
- Field member: James Thomas Brenna
- Minor member: Nancy M. Wells
- Minor member: Corinna E. Loeckenhoff

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CHAPTER 1

INTRODUCTION

1.1 Fish and seafood: the current health situation

Fish and seafood are widely touted as healthful foods by a wide range of voices, from federal agencies setting dietary guidelines to health columnists to scholars. Lim and colleagues estimate that as many as one million deaths worldwide in 2010 were attributable to diets low in seafood (Lim et al., 2013). Both the World Health Organization and the United States Department of Agriculture recommend fish and seafood intake as part of a healthful dietary pattern; the WHO suggests two servings per week (*Joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption*, 2010) and the USDA's Dietary Guidelines recommends eight oz, preferably fatty fish, per week (USDA, 2015). However, Americans fail to achieve this intake level. Mean US intake remains approximately four oz per week (Rehm, Penalvo, Afshin, & Mozaffarian, 2016), although there is some indication that intake may be increasing (Van Voorhees, 2015). This gap is concerning: eating fish is a simple behavior that is associated with health benefits.

These health benefits are likely due to certain components of fish and seafood. Many types of fish are categorized as lean proteins, or lower fat sources of protein, and others are unique sources of omega-three fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (Mahan, Escott-Stump, & Raymond, 2012). EPA and DHA are only found in animal foods (with the exception of certain algal oils), and only at low levels in land animals fed a diet not supplemented the EPA and DHA. EPA and DHA are also found in supplements

and fortified foods. However, neither supplement use nor fortified foods have increased EPA and DHA intake to ideal levels (Nesheim et al., 2007; Papanikolaou, Brooks, Reider, & Fulgoni, 2014). Fish and seafood remain a straightforward approach to meeting EPA and DHA goals.

While most Americans do not eat the recommended amount of fish, most Americans eat it occasionally (Daniel, Cross, Koebnick, & Sinha, 2010). Fish is an entree option that could be substituted for other types of protein into many common American meals. Furthermore, many regional cuisines already contain fish and seafood dishes that are culturally acceptable to residents in the area. As a health-related goal, the frequency of recommended fish consumption is relatively low (twice per week), compared to some other recommended health-related behaviors. For example, vegetables, whole grains, and exercise are all recommended at daily or near daily levels (USDA, 2015). Setting a goal to change an eating behavior once or twice a week may be an achievable change that leads to benefits in the future for individuals and society.

Fish consumption is associated with better cognitive health: those with higher consumption or higher omega-3 values exhibit decreased risk of depression, suicide, cognitive impairment, and other psychiatric illnesses (Freeman et al., 2006; Cardoso, Afonso, & Bandarra, 2016). Some negative findings (Jiao et al., 2014) have cast doubt upon this association, but weaknesses in these research designs neglected to account for important methodological factors. For example, there appears to be a threshold value below which risk for conditions affected by omega-3 status is increased and over which risk for conditions affected by omega-3 status is decreased (Harris, 2010). Controlling for intake and initial omega-3 values is essential for evaluating which individuals, in research

or clinical settings, have the potential to benefit cognitively.

The public health burden of these cognitive and mental health conditions is considerable: approximately 20% of US rural adults reported a depressive condition (Shaw, Theis, Self-Brown, Roblin, & Barker, 2016); the cost of caring for an older adult with dementia was estimated at more than $40,000/year (Hurd, Martorell, Delavande, Mullen, & Langa, 2013). Delaying the incidence of these conditions, reducing the severity, or preventing them altogether could improve the quality of life for individuals with the condition and their caregivers while decreasing costs of treatment and loss of productivity. Shifting the protein source for a main meal two times a week would be a relatively minor intervention for potentially substantial gains.

1.2 The fishy grail: omega-three fatty acids

The benefits of eating fish and seafood are hypothesized to be primarily due to the EPA and DHA content. EPA and DHA are polyunsaturated omega-three fatty acids, which means there are multiple double bonds between the carbons, including one double bond at the third carbon from the end of the carbon chain (Mahan et al., 2012). Omega-three fatty acids play a number of roles in body. EPA and DHA are incorporated into the membranes of cells and are found in particularly high ratios in the brain (Brenna, Salem, Sinclair, & Cunnane, 2009). Both EPA and DHA are needed for bodily functions and can be produced by the body from alpha-linolenic acid, a common fatty acid found in seeds like flaxseed and walnuts (Mahan et al., 2012). In this dissertation, omega-3 fatty acids will refer solely to animal-derived EPA and DHA although the term technically in-

cludes more molecules (Mahan et al., 2012). In adults, endogenous generation of the omega-3 fatty acids EPA and DHA from plant sources was found to be very low and negligible, respectively (Brenna et al., 2009). Thus, consuming either supplemental or animal sources of EPA and DHA are the best ways to improve EPA and DHA levels. Fish and seafood offer the most EPA and DHA, compared to other protein sources.

1.3 The horrors: contaminants

One reason for the lack of whole-hearted promotion of fish and seafood is concern about health effects of consuming pollutants that have bioaccumulated through the food chain. Specific pollutants lead to different concerns for different populations, and varied local, state, and national agencies monitor for the contaminants of concern in their water bodies (Gewurtz, P., McGoldrick, de Solla, & Murphy, 2011; Nesheim et al., 2007). A brief review of some major issues in fish and seafood contaminants is presented below.

Mercury

Mercury is a prominent contaminant of concern. The Environmental Protection Agency in the United States monitors levels of mercury in fish and seafood, issuing periodic statements with the Food and Drug Agency about consumption recommendations based on toxicological studies related to health outcomes (*Questions and Answers from the FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017). Mercury is a concern in determining recommendations for fish and seafood because it is the primary source of

mercury exposure for Americans (Nesheim et al., 2007; Karimi, Fitzgerald, & Fisher, 2012). Recently issued recommendations focus on the species of fish and frequency of consumption (*Questions and Answers from the FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017). Mercury is typically found at the highest levels in large, older, predatory animals in several forms, the most concerning of which is methylmercury, an organic form that is well-absorbed from the gastrointestinal tract (Nesheim et al., 2007).

A reference level for mercury intake was developed using a single exposure approach with an added safety measure: what level of exposure to just methylmercury (ignoring other components of the food) could cause harm? The Environmental Protection Agency reference level for fetal exposure, which guides recommendations for fish intake, was 0.1 microgram per kilogram bodyweight (Nesheim et al., 2007; *Technical Information on Development of Fish Consumption Advice - FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017). However, when the benefits of the omega-3 fatty acids for fetal development were included in the risk-benefit calculation for fetal neural development, fish appears to be more protective than the Environmental Protection Agency suggests. Benefits exceed risk for less than 10 servings/week of most fish and seafood regularly consumed by Americans (McGuire, Kaplan, Lapolla, & Kleiner, 2016). However, the level at which risk exceeds benefits would be reached with fewer servings, four to six, of high mercury species, such as shark and tilefish (McGuire et al., 2016).

Persistent organic pollutants: dioxins and more

Persistent organic pollutants (POPs) describe several groups of chemicals, often used in agricultural, industrial, or incineration settings (Nesheim et al., 2007). These chemicals persist in the environment, and often vary widely based on the water body and even the area within the water body (Nesheim et al., 2007; Gewurtz et al., 2011). State and local authorities typically monitor these levels and provide recommendations for intake based on water testing and analysis of the catch. Unlike mercury, POPs often accumulate in the fatty tissue, so trimming the fatty layers of flesh off the fish can reduce exposure in areas with high levels of POPs (*Health Advice on Eating Sport Fish and Game*, 2016; *Questions and Answers from the FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017). However, this may also remove some of the omega-3 fatty acids.

Currently, evidence supporting negative health effects from POP exposure via fish and seafood among Americans is lacking. Uncertainty is present in terms of the level at which long-term health effects, such as cancer, may occur (Nesheim et al., 2007). The IOM estimated that nearly 10 times as much POP exposure occurs through meat as through fish and seafood for the general population, although sport fishermen who eat their catch may have higher exposures (Nesheim et al., 2007). Fortunately, regulation of POPs has increased so levels of some are declining although they are expected to persist in the food supply in the future (Nesheim et al., 2007; Gewurtz et al., 2011).

Media coverage of contaminants

Concerns about guidelines related to contamination, including approval of genetically-modified salmon, were widely discussed in the media prior to, and during, the present research project's timeline. Mercury contamination guidelines have been widely publicized, particularly in regard to pregnant women and toddlers, in both mainstream print and broadcast media. One analysis of media coverage of how two major newspapers framed mercury contamination indicated that the brunt of the action was placed on individual consumers: limit one's intake of high mercury fish (Fitzgerald & Baralt, 2010). Furthermore, additional articles about aquaculture production methods and potential sources of contaminants and food safety risks were also widely discussed prior to the research project (for example, St. Fleur (2016) reported on potentially harmful mislabeled fish and and Greenburg (2015) proposed rules for eating fish safely). While a concurrent content analysis of media coverage was beyond the scope of the project, it is important to note the constant and evolving contribution of the media to the information pool from which ideas may be drawn from by individuals.

1.4 Previous research about fish choice

Previous research suggest a number of reasons that may explain the gap between ideal consumption and actual consumption of fish and seafood but little research has been conducted in the United States in the past 20 years. Carlucci's (2014) review article focused on consumer behaviors related to fish and seafood products only found three articles using an American sample, includ-

ing one focused on anglers (Burger & Gochfeld, 2009) and one experiment about mercury warnings (Hughner, Maher, Childs, & Nganje, 2009). The third article reports results of a survey in the Northwest, which suggested some concern about aquaculture (Hall & Amberg, 2013). In older research conducted in the United States, concern about cost, quality, and taste preferences were common (Weinstein, 1995). In other nations, a variety of other aspects have been evaluated, including fish's availability, convenience, production methods, packaging and labeling, and the consumer's health beliefs, fish eating habits, and self-efficacy (Carlucci et al., 2014). This project will add to knowledge about consumers and their choices related to fish by exploring contextual factors relating to the ways the health effects of fish are understood and characterizing the procedures for fish provisioning in a rural area of the United States.

1.5 Midlife adults: risk and opportunity for change

Midlife adults offer two advantages for a population to examine fish intake. First, they are at an age where rates of health-related morbidities affected by fish and seafood consumption, such as cardiovascular disease, are beginning increase (Lachman, 2004). Second, they are at a life stage where they are potentially open to making changes in their health-related behaviors. Research shows that midlife adults spend more time and effort on their health than younger adults; for example, they are more concerned with eating healthfully and they eat slightly more fish (Rehm et al., 2016; Bisogni, Jastran, Seligson, & Thompson, 2012). They are also experiencing life course changes related to their families and careers that prime them for changing habits and routines (Lachman, 2004). Increased vulnerability to illness combined with interest in behavior

change suggests that this population may be receptive to adopting behaviors introduced by public health interventions.

1.6 Rural settings

Rural areas provide a unique setting for research about fish, seafood, and potential chronic health conditions related to fish and seafood consumption. They offer a juxtaposition of resources for food access. A bounty of natural resources may be available but commercial infrastructure and points of sale may be limited. Concurrently, health disparities suggest a need for public health interventions, including nutrition-based work.

On one hand, rural areas may provide natural resources which can supply raw materials for foods (Flora, 2015), including whole fish. In the area where this research was conducted, there are a number of waterbodies which contain (naturally and through stocking) edible fish. Some prominent lakes with public access fishing in the research area include Seneca Lake, Cayuga Lake, and Lake Ludlow as well as private and public ponds and streams. Common species consumed include perch, trout, sunfish, walleye, lake salmon, and bullhead catfish.

On the other hand, opportunities to purchase fish may be different in rural areas than in urban areas. Rural areas may be underserved by commercial grocers, with higher costs, lower variety, or greater travel distances (Gantner, Olson, Frongillo, & Wells, 2011; Morton, Bitto, Oakland, & Sand, 2008). One store evaluation in South Carolina found that fresh fish was not available in 18% of supermarkets and 37% of grocery stores (Liese, Weis, Pluto, Smith, & Lawson, 2007). In combination with the health disparities described below, these ele-

ments are concerning indications of an underserved population that may benefit from public health nutrition interventions.

Finally, rural populations are vulnerable to health and nutrition-related disparities, including conditions related to low fish and seafood consumption. Rural adults face a higher risk of excess mortality from heart disease and stroke, compared to suburban and urban adults (Moy et al., 2017). In addition, the rates of self-reported poor health and depressive disorders among adults are slightly higher in non-metropolitan counties than metropolitan counties (Shaw et al., 2016).

1.7 Conceptualizing the project

The design of this project emphasized triangulation of basic theoretical frameworks from the psychological and sociological literature to examine the cognitive basis of choices that, over time, contribute to physical states related to long-term health. Behaviors and actions can be observed using ethnographic methods and calculated through use of foodstuff disappearance data. However, the underlying reasoning, beliefs, and cognitive basis for individual and group practices that underlie behaviors and actions are best examined using theories and models. These theories and models offer an opportunity to connect individual and shared thoughts to concrete actions, including repeated behaviors and the formation of practices and routines. Repeated behaviors are important to consider in terms of long-term nutritional intake and chronic disease risk: while one day's actions only occasionally lead to a disabling condition, repeated meal choices contribute, ounce by ounce, toward a conditions such as stroke, myocar-

dial infarction, or the development of dementia.

Several specific theories were applied in this research project to guide the data collection and analysis across the two studies. The biopsychosocial framework (Engel, 1977) guided the broader project design: examining the influences of social context and individual psychological states on the biological condition of the body. The data presented in Chapters 2 and 3 focused on the social context and psychological states. It was collected using in-depth interviews and analyzed inductively using social representations theory, which examines one aspect of social context, and the constructivist concept of scripts, an individual cognitive structure. The study presented in Chapter 4 uses a deductive approach to analyze data from a survey and blood sample. It integrates the findings from the previous chapters with self-reported fish intake and a biological marker.

The theory presented in Chapter 2 is social representations theory. Social representations theory proposes that communities use shared ideas and knowledge structures to organize information about the world (Markova, 2015). Social representations contain thoughts, ideas, images, and knowledge. These are created through social communication; they evolve as communication occurs and ideas shift. A unique aspect of social representations theory is the emphasis on the evolution of ideas: using a social representations framework encourages recognition of the ways in which concepts quickly respond and evolve in response to new situations and information. Individuals use their personal set of social representations to locate both information and objects in a familiar context, and thus social representations can influence their behaviors, practices, and choices (Augoustinos, 2014). In the present project, specific social representations re-

lated to the health effects of eating fish and seafood were examined.

In Chapter 3, in contrast, scripts, a type of cognitive map for the steps involved in different activities, were used to examine the behaviors related to eating fish and seafood. Scripts are a type of schema and have been applied to a number of different activities. For example, Blake described evening meal scripts (2008). The present analysis is the first in which scripts for related activities (in this case, food acquisition, food preparation, and eating out) are analyzed individually and then connected through the newly proposed concept of script integration. Given the observed connections between food skills and eating, considering the integration of scripts may be valuable for future research.

In Chapter 4, a quantitative analysis used a biopsychosocial approach to connect social and cognitive constructs to biological values. The biopsychosocial approach used here theorizes that the physical state develops within the context of the psychological, social, and cultural determinants of health and illness (Engel, 1977). The survey incorporated items based on findings from Chapters 2 and 3 in order to test hypotheses about how different psychological beliefs predict both fish and seafood consumption and omega-3 status. A notable aspect of this approach is the integration of the project across the levels of the model, from community-wide ideas through individual behavior to the molecules in red blood cells.

Finally, in Chapter 5, the findings from all three chapters are integrated. The limitations and strengths of the research project are discussed. Proposals for future work to further develop the theoretical findings and practical applications are made. Finally, concrete suggestions for application of the findings on individual, community, and policy levels are described. Both the qualitative results

and the quantitative results offer a range of directions for future work in both research and applied settings.

CHAPTER 2

SOCIAL REPRESENTATIONS OF FISH AND SEAFOOD AMONG MIDLIFE RURAL ADULTS: BENEFITS, RISKS, AND UNCERTAINTY

2.1 Introduction

Understanding both socially shared and individually held concepts about the healthfulness of fish and seafood is economically, politically, and nutritionally important because fish is a both a trade commodity and a common part of many people's diets. Many policy and health groups have proposed and promoted recommended intakes of fish and/or seafood. However, despite widely acknowledged health benefits, there are also potential risks associated with eating fish and seafood. Developing effective future policies and guidelines depends on 1) valid, reliable, and current scientific knowledge about fish nutrition and toxicology, and 2) understanding how people currently think about and manage existing health knowledge and guidelines about fish and seafood.

Fish is widely recognized as having substantial positive health effects. Fish is a major source of omega-3 fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Optimal ratios of omega-3 fatty acids are important for cardiovascular and neurological health (Kris-Etherton, Harris, & Appel, 2002; Zhang et al., 2016). A recent meta-analysis found decreased mortality among those who consumed 60 g or more of fish per day (Zhao et al., 2016). In addition, fish is often recognized as a part of healthful dietary patterns such as the Mediterranean diet (Willett et al., 1995).

Concerns exist about potential negative health effects from eating fish and

seafood, including microbial and chemical contaminants. Foodborne illnesses, like ciguatera infections or paralytic seafood poisoning, are a risk to fish and seafood consumers. Low levels of chemical contaminants such as dioxins (*Joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption*, 2010) and methylmercury are found in fish and seafood (Agency for Toxic Substances and Disease Registry, 1999). Exposure to these contaminants at high levels, such as through industrial accidents or long-term occupational exposure, leads to negative health outcomes. Dioxin has been linked to cancer and changes in immune and endocrine function (*Joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption*, 2010). In adults, high intake of methylmercury has the potential to lead to neurological impairment, kidney damage, and reproductive impairment through damaging sperm or a fetus (Agency for Toxic Substances and Disease Registry, 1999).

Policy-making bodies like the World Health Organization (WHO) encourage nations to develop a detailed understanding of the risks and benefits of the fish and seafood items consumed by their residents, and to then effectively communicate both benefits and strategies for risk management (*Joint FAO/WHO Expert Consultation on the Risks and Benefits of Fish Consumption*, 2010). These guidelines have the intent of promoting health by decreasing chronic disease burden and minimizing exposure to harmful environmental pollutants. The 2015-2020 United States Dietary Guidelines recommend eating 8 or more ounces of seafood per week for adults, focusing on including a variety of lower mercury species for those who consume more than the minimum recommendation (USDA, 2015). In contrast, within the United States, individual state agencies have issued restrictive fish consumption advisories ranging from eating "up to four meals per month" to "DON'T EAT" focusing on fish from specific local

water bodies (*Health Advice on Eating Sport Fish and Game*, 2016).

A range of health, non-profit, and consumer organizations have also developed position statements or guidelines suggesting how much or what types of fish consumers should eat. For example, the American Psychiatric Association supports intake of omega-3 fatty acids from fish and seafood as a safe and somewhat effective for some mental health conditions (Freeman et al., 2006). Environmental organizations emphasize caution in terms of contaminant exposure, recommending lower intake that is focused on high omega-3 species (e.g. Boyle, 2015). The ecological status of fisheries and sustainability also adds another dimension that may be incorporated into consumer understandings of what fish are best to eat (Oken et al., 2012). As food systems evolve and knowledge about nutrition, production methods, water quality, and ecosystems expands, continued development and revision of fish consumption guidelines for optimal human health by multiple stakeholders will undoubtedly occur.

Position statements about nutrition and health written by governments and organizations, however, are not what the general public usually reads or hears. These conflicting health policy messages are regularly condensed and presented to the public via advertisements, print or television news media, or through social media platforms (Greiner, Clegg Smith, & Guallar, 2010). Press releases from non-profit organizations may receive substantial news coverage (e.g. St. Fleur, 2015). Health messages about fish intake are complex, with recommendations about minimum frequency to achieve health benefits, maximum frequency to avoid health risk, specific target populations, best and worst species to eat for different reasons, and recommendations for preparation methods (Oken et al., 2012). Elements of this information can conflict, depending on the interpretation

and presentation of the material, and produce uncertainty among consumers (Pieniak, Verbeke, Scholderer, Bruns, & Olsen, 2008). For example, midlife adults (in this study, over age 50) who are not likely to be pregnant or breast-feeding but who may be at risk of cardiovascular disease are not the target of recommendations to limit fish consumption due to potential risks to fetal and infant brain development. However, media coverage about mercury in fish often leaves the specific target population recommendation buried in the text and not explicitly highlighted.

Given the role of fish as a contested food – both healthy and potentially unhealthy– one theory suited for examining how people deal with fish is social representation theory. Social representation theory describes a set of shared and personal ideas in social groups that orients "actions and social relations" (Abric, 2001). Social representations are shared and personal thoughts, ideas, images, and knowledge created through social communication (Markova, 2015). Social representations held widely across a social group form a central "core" while those less commonly held are "peripheral" elements (Abric, 2001). Conflicting representations can be held by the same individual or group at the same point in time. Two processes describing how representations are formed include anchoring and objectification (Moscovici, 2001). Anchoring refers to a process by which new ideas are related to known concepts, while objectification is a process by which new ideas are developed and made concrete (Augoustinos, 2014). Social representation theory offers a potential way to understand conflicting healthy and unhealthy contestations of fish and seafood.

To investigate consumers' social representations of the health effects of fish consumption, we studied people who ate fish and seafood. The three main aims of

the study were 1) to examine midlife rural adults shared and personal representations of the health benefits and health risks of eating fish and seafood in their daily lives, 2) to understand how the processes of objectification and anchoring occurred for key social representations related to fish and seafood and 3) to relate how these consumers managed those representations in relation to routine fish and seafood food choice.

2.2 Methods

Setting and participants. Participants were recruited from three rural counties in New York State, USA, via ads, flyers, community listservs, group meetings, and word-of-mouth between July 2014 and March 2015. New York State is a large northeastern state with diverse geography. Each county selected for this study is classified as non-metropolitan, with an urban population of less than 20,000 people (USDA, 2013). Each county has several small towns, including the county seat (capital), and substantial outlying populations. A variety of housing options is available in each county, from single-household homes on farms to subsidized senior apartments in towns. There are multiple supermarkets and additional grocery options such as superstores or discount chains selling food in all three locations. All three counties have access to waterways for fishing; two counties have lakes that are among the cleanest in the state. New York State provides information about fish consumption advisories to individuals when they purchase a fishing license and online.

Eligibility criteria for participants included being between age 50 and 70, having eaten fish or seafood in the past year, preparing half or more of the meals

consumed at home, and having no severe illness that would impair their ability to eat typical meals or give consent (i.e. dementia, dependence on tube feeding). Purposeful recruiting was used to seek a sample with varied fish-related experiences, including men and women, people who worked full-time, those who were retired, those who lived alone and those who lived with a spouse or family, varied subjective financial situations, varied fish intake levels, and distribution across the three counties. A total of 31 participants, 11 men and 20 women, were recruited, which is congruent with most in-depth interview sample sizes (Safman & Sobal, 2004). Upon discussing the field notes and reviewing the themes emerging in the interview transcripts, the authors judged that sufficient data saturation (Charmaz, 2006) in relevant study topics had likely been met and ended recruitment.

The ethnicity of the sample was all white, with one person identifying as white-Hispanic. Ages varied, with five between ages 50-55, eight between ages 56-60, nine between ages 61-65, and nine between ages 66-70. In their households, 11 lived alone, 12 lived with a spouse, seven lived with family, and one had another living arrangement. The group was also diverse in employment: 12 worked full time, 6 worked part time, 11 were retired, and one had another occupational status. Three participants were secondary school graduates or equivalent, 10 had some college, 10 had a two or four year college degree, and eight had a graduate or professional degree. Their subjective incomes included one participant who reported ”cannot make ends meet”, one who needed to ”cut back”, eight who had ”enough but not extras”, 20 who were ”comfortable with extras”, and one who preferred not to answer. The majority, seventeen, of the participants ate fish or seafood less than once a week, while nine ate it once or twice a week, and five ate it more than twice a week.

Data Collection. Each participant completed a brief demographics form to provide participant characteristics, including frequency of fish and seafood consumption, prior to engaging in an in-depth interview. One interviewer (the first author) conducted all interviews in a quiet location convenient for the participant, such as their workplace, their home, an office at the university, and local restaurants. In most cases, no other people interacted with the interviewer or participant during the interview. The interviews followed a semi-structured interview guide created using questions related specifically to fish procurement and preparation as well as topics that influence food choice. Minor revisions were made to the interview guide several times during the study to include additional questions about themes emerging in earlier interviews. Probing and member checks about participant responses were used throughout the interviews to enhance the depth of the data (Charmaz, 2006). A selection of the questions used to elicit social representations about fish and seafood included:

- Tell me about your experiences buying fish and shellfish.
- What else do you consider when you are buying fish?
- Tell me about what you hear about fish in the media.
- What do you hear about fish from friends or family?
- What do you believe about the health benefits of eating fish?
- How has hearing "**BLANK**" changed your fish eating habits?

The interviews ranged in length from 24 to 66 minutes, with most around 40 minutes. All interviews were audio recorded and transcribed verbatim. The interviewer reviewed the transcripts for accuracy and completeness. Brief field notes were taken by the interviewer after each interview. Participants received

a small honorarium in appreciation for their time. The University Institutional Review Board approved the research protocol and participants provided written informed consent.

Analysis. The research team discussed the field notes and transcripts to identify emergent themes and develop a codebook using a constant comparative approach (Charmaz, 2006; Miles & Huberman, 1994). The transcripts were iteratively coded in Atlas.ti 7.1 software (Scientific Software, 2014) by the first author. Throughout the analysis process, relationships between the codes and themes were discussed and developed. A second experienced coder, independent from this research project, also coded five interviews using the established codebook in Atlas.ti 7.1 to confirm conceptual consistency; the first author compared the transcripts and found congruent use of the codes. Credibility of the findings was enhanced through peer debriefings throughout data collection and analysis, member checks, and use of an audit trail (Miles & Huberman, 1994).

2.3 Theory

Social representations theory was used to examine and interpret the shared and personal understandings of fish and other seafood. The thoughts, ideas, images, and knowledge contained in social representations evolve as those ideas change (Moscovici, 2001). A unique aspect of social representations theory is this emphasis on the dynamism of shared ideas. Social representations thinking recognizes the ways in which concepts can quickly respond and evolve in response to new situations and information, which is important to the shifting patterns of fish-related guidelines and policies. Core representations are more

stable and persistent across changing situations and environments, while peripheral representations are flexible and shift more easily in response to both individual and contextual variations (Abric, 2001). Many representations are held about the same concept or object, and social representations may conflict with each other, both within and individual's set of representations and a group's set of representations.

Representations develop through interpersonal contact, interaction with mass media, or other forms of communication and discourse (Markova, 2015). Individuals use their personal set of social representations to locate both information and objects in a familiar context, and thus social representations can influence individual behaviors, practices, and choices (Augoustinos, 2014). Anchoring uses culturally well-known items or ideas to classify and name unknown new objects or concepts through comparison (Moscovici, 2001). Objectification occurs when a novel abstract idea is made more concrete as it is conceptualized in a way that then shapes reality.

Social representations theory is suited to examining risk as related to scientific and health information (Joffe, 2003). New concepts often move into popular culture so they develop social representations that may differ from the professional or expert definitions (Markova, 2015). Social representations theory prioritizes recognizing the transformation of concepts into plural facets as they shift from the expert field into popular knowledge without assuming the view that concept distortion occurs as the concepts evolve from specific expert to complex public definitions (Joffe, 2003). The social representations of contested food-related concepts and their risks, including genetically modified foods (Wagner & Kronberger, 2001), organic foods (Bartels & Reinders, 2010), and food irra-

diation (Gauthier, 2010), have been examined using a variety of methods and provide examples of the usefulness of social representations to understanding fish and seafood.

2.4 Results

The social representations about fish and seafood discussed by participants in this study were grouped into five domains: Intrinsic components, Contaminants, Health, Fish as protein, and Fish Type. Figure 1 presents the social representations of health benefits and health risks grouped by domain, with the core representations in capital bold text in the center and the peripheral representations in non-bolded text along the edges. The sections below discuss the core and peripheral representations and the processes of anchoring that occur in each domain of social representations. Objectification was a less prominent process in these interviews, and will only be discussed in relation to selected social representations. The ways individuals interact with the social representations will then be discussed in the next section of results.

2.4.1 Social representations domains

Intrinsic components. Participants understood the intrinsic components of fish as both potentially problematic and health bestowing. Problematic ideas that emerged in relation to health-related reasons to avoid fish and seafood included several naturally present components (that is, non-pollutants). Bones, cholesterol, parasites, and fish parts were discussed both related to general ideas of

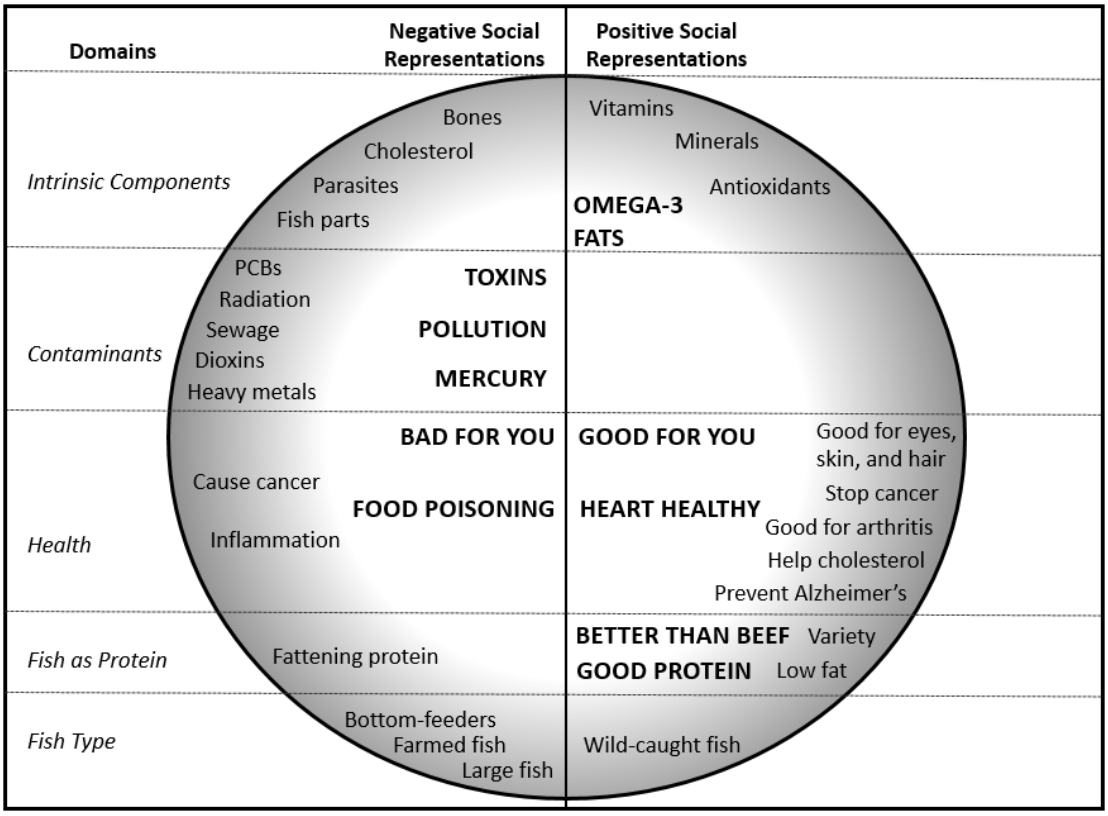


Figure 2.1: Positive and negative social representations by domain

risks of eating fish, like choking hazards, and personal ideas about edibility. The "bony" reputation of specific species, such as flounder, were mentioned as a choking hazard while others just talked about avoiding bony fish or choosing to eat fish even though it had many bones. Cholesterol was often described as a reason seafood was avoided. As one man said, "since we both have to watch our cholesterol intake, we kind of minimize shellfish." A few participants also briefly mentioned worms or parasites as concerns when it came to fish and health. Other intrinsic aspects of fish that participants reported avoiding were based upon personal tastes, like one participant who said "I can't eat something thats got eyes still in it" or another who experiences a "queasy sensation" prompted by fish skin.

Nutrients intrinsic to fish were described by many participants when they discussed how fish was good for them. Omega-3 fats or "good fat" was a core representation mentioned by nearly all participants using one of several variants, including "good omegas" or "omega oils." They were broadly described as health bestowing, like stating omega-3 "type of things are good for you." The process of developing this understanding was clearly embedded in personal and media communications about fish representations, as described by one participant: "the media and everybody said, you know, you should have omegas in your diet. And so do the doctors, you know, say you should have omegas in your diet."

Objectification was occurring for some participants in terms of omega-3 fatty acids, with varying complexity of conceptualization. Most recognized that omega-3 fatty acids were unlike other categories of nutrients like vitamins or minerals they already knew about–"I was really thinking omegas when I said anti-oxidants. That's different, right? Yeah." All recognized the omega-3 fat as a potentially health enhancing component found in fish, in contrast to how fat was usually described as a negative component of other foods in their diet. As one woman said, "the fats that are in fish are better for you than those that are in meat or poultry." Omega-3 fatty acids, as a novel kind of nutrient, could not be represented similarly to the fat they encountered in beef or from fried foods.

Some participants also non-specifically referred to fish as having vitamins, minerals, or antioxidants; they were broadly using anchoring with popular nutrient-related terms they already knew without referring to any specific nutrients (such as iodine). The process of anchoring sometimes involved connecting a nutrient to a specific health conditions, as when omega-3s would "help not only

your heart but also your eyes," but some participants more generally referred to a category of nutrients simply as evidence that fish was good for you.

Contaminants. Contaminants were understood to be unhealthy substances not inherently or naturally present in the fish and seafood. Both technical names–such as mercury or PCBs–and general terms like pollution and toxins were used to discuss contaminants. Participants spoke generally– "You look at the water today. All the problems we have with the water"–and also specifically in terms of industrial accidents or local polluted lakes and rivers. Other specific contaminants mentioned included radiation (from nuclear power plant accidents), sewage, dioxins, and heavy metals. No positive social representations of contaminants were described by any participants.

Both objectification and anchoring were utilized for representations of contaminants. Specific accidents or bodies of water contaminated by industrial activities provided reference points that acted as anchors from which understanding of pollution or radiation could be developed. One notable accident leading to concern about fish contamination was the nuclear accident at the Japanese Fukushima power plant, to the point that one woman said "I don't think I want to eat anything from the West Coast any time soon." Local bodies of water were often used a reference point, particularly by those who were more involved in the fishing world, like one woman who listed three rivers where she would avoid sourcing fish, saying she was "Just too worried about pollutants."

Other concepts, like mercury and toxins, were undergoing objectification as the popular meaning of these developed and became widely more shared. Mercury was a core representation of how fish contaminants could be unhealthy. Despite being a prominent concept, many had uncertainty about mercury and it was of-

ten vaguely discussed. One person did not have the "foggiest idea why, how people could know that [about mercury] in the first place." No participants had a sense of any specific mercury-related health implications for themselves, saying things like: "I'm not even sure about mercury... Where the mercury comes into play." Mercury in fish had entered the public discourse about fish representation, but the most common elements present in their knowledge set are a sense of danger tied to the food source. Only a few people described where mercury contamination occurred or how it becomes an issue for fishing and aquaculture. Overall, mercury had undergone objectification and was now conceptualized as a symbol of dangerous contaminants in fish and seafood for many participants.

Health. Health was discussed in terms of treating disease, avoiding disease, and maintaining specific parts of the body. Participants described how eating fish and seafood could help cholesterol, stop cancer, prevent Alzheimer's disease, and how it was good for arthritis; they also mentioned how it was good for eyes, skin, heart, and brain. For example, one person described fish as being a "protein without, you know, kind of, increasing the kind of foods that sort of lead to heart disease." Fish oil was specifically credited with successfully treating dry eyes. In these situations, participants used the process of a known health condition to anchor the health benefits of fish and seafood. Participants described having these conditions personally in a few cases, or they mentioned friends, family, or pets who did.

In terms of being "bad for you," participants connected eating fish and seafood to causing cancer, food poisoning, and inflammation. Explaining the ways in which eating fish and seafood could have a negative impact on health conditions was conceptually difficult for most participants. Few had specific answers

beyond concerns about food borne illness; however, two individuals used their personal health-related fears–recurrence of recent kidney stones for one and ending up in a wheelchair for another–as a known category acting as an anchor for representations of possible consequences of fish consumption. Personal health did not emerge as concerns for other participants, however. Cancer was a mentioned by some participants as a vague health risk related to fish consumption; although nobody specified a type of cancer. One participant offered a specific anecdote, describing how reading a book that included information about fish led him to reduce his fish intake because the author "conclusively said that a lot of these cancers were linked directly with the pollution of the waters and the consumption of various fish." A few participants mentioned fish and seafood contributing to inflammation, with one going into more detail.

Fish as protein. Eating a range of types of protein was seen as a way of eating healthfully by a few participants, and fish was one way to add variety. It could then be substituted for other proteins as when "half the time I buy fish rather than a hamburger." Fish was an alternate to the more usual beef and chicken, or pork. It was seen as important to include it as "something different." Anchoring was used by some when discussing the value of eating fish and seafood–fish was similar to other protein foods, although somewhat different.

Some participants also discussed fish and seafood comparatively in relation to other animal protein foods–which was best to eat? Fish was often described as being "better than beef" or even "less evil." One participant described it as "comparable to chicken." In these cases, the nutritional value of beef or chicken was the familiar domain anchor from which the nutritional value of fish was evaluated. Their common sense understanding of what made it better, however,

emerged from broader discourses about protein foods, particularly in terms of fat and managing weight. Fish represented a ”low fat” protein option, particularly when prepared in certain ways. Participants, more often women, used phrases like ”lean” and ”light” to describe fish, or said fish was an option for ”weight control.” However, this representation was nuanced; for example, lobster and bluefish were referred as a ”fattening” by one participant and a number of participants excluded fried fish from this social representation about weight.

Fish type. Specific categories of fish were considered less healthy, or even unhealthy. Some species were often avoided or limited due to intrinsic components, such as concern that they were high in cholesterol, like one woman who said lobster was ”very high in cholesterol so I dont eat it.” ”Bottom-feeders,” described as catfish or swai, were also thought to be higher in unhealthy contaminants. One woman said ”I love swai. They say its not a good one to eat because it... it feeds on the bottom.” In some ways, the fish were considered cheap or unclean because of what they ate, which could affect both taste and health. Larger fish were also described by a few participants as being higher in contaminants, due to ”the build-up” over the food chain of ”eating everything that that fish also ate.”

The peripheral social representation of farmed fish was dynamic and, as an unfamiliar production practice to many of the participants, it appears to be currently undergoing objectification. A number of participants described farmed fish as ”not very good for you.” Some participants spoke fervently about avoiding farmed fish, including due to environmental, health, or taste concerns, while others disregarded production method. Some said they avoid farm-raised fish because it is fed ”fish feed thats not what they normally eat which changes the

chemistry a little bit, of the fish, and it could be... a source of inflammation" while others discussed that the fish "live in filthy tanks." A few of these participants reported reading the same media sources. Others, however, were comfortable with farmed fish and seafood, describing it as "ok" and "mussels raised on a rope... no problem."

2.4.2 Fish and seafood as contested foods

Positive and negative social representations related to the health effects of eating fish and seafood emerged in a variety of domains, showing how extensively the health value of eating fish was contested. Participants spoke of fish and seafood as generally being "good for you" and "healthy." Positive core representations in terms of health included that fish was heart-healthy, good for you, good protein, a better choice than beef, and that it contained omega-3 fatty acids. In contrast, negative core representations in terms of health effects, or ways that fish was "bad for you," included that it contained mercury, it was polluted, it contained toxins, and that it could cause food poisoning. Anchoring was seen in the comparison of fish to other foods and through the use of broad health and nutrition terms used commonly for multiple foods, especially in the domains of Intrinsic components and Fish as protein. Objectification occurred when participants were faced with novel fish and seafood-specific information, particularly science and health information, and were developing new ways of understanding. For example, objectification was used by participants for discussing contaminants.

2.4.3 Involvement: How ideas meet eating

Participants readily described the social representations of the health risks and benefits of eating fish and seafood presented in the media or by friends and family during the interviews. However, they expressed a great deal of skepticism, uncertainty and lack of confidence in the accuracy of these representations. Many participants used qualifiers in speaking about fish that suggested uncertainty and lack of confidence, using phrases like ”I think,” ”maybe,” ”probably,” and ”isn’t it?” more frequently while talking about the health risks and benefits of eating fish and seafood than other topics like price, taste, or cooking.

They also talked about a lack of certainty about whether they could actually know what was in their fish. One participant had a more detailed understanding of the role of mercury in the ecosystem but still felt it is ”one of those things that’s there but how could you ever determine how much is any specific fish you’re eating?” Another participant summarized how most people felt when he said he had ”no specific way of knowing exactly what’s in your fish.”

Some participants also struggled with deciding whether fish was a food they should be eating for their health because of conflicts between holding both positive and negative health-related social representations. As one person said, ”first they said it’s good for you, and then they say it’s bad for you, and then it’s good for you, and then it’s bad for you. And I’m thinking... So it’s to the point really, where, I don’t know. Is it really good for you, is it really bad for you?” Another woman felt that the debate about whether it was not good for her was the ”only drawback to having fish” and eventually concluded she felt it was ”probably not good so I’d better cut back.” Many participants had absorbed both the positive and negative health messages about fish and seafood,

felt conflicted, and saw no clear resolution to the conflicts.

Negotiating those conflicting positive and negative social representations was challenging for some when it came to their own personal eating preferences, and this uncertainly and personal conflict led to different types of involvement with fish and seafood-related social representations. Four main types of patterns of involvement with the social representations emerged from these interviews: Evangelists, Safeguarded, Oblivious, and Risk Managers.

Evangelists. Evangelists were deeply involved with either the positive or negative representations of fish and often spoke with substantial confidence about either the health risks or health benefits of eating fish or seafood. They had dramatically changed the way they ate to eat substantially more or nearly totally avoid fish and seafood. Their commitment to their position led them to speak with more emotion than most other participants. One Evangelist stated eating fish and seafood was very unsafe due to the pollutants and radiation, avoiding it entirely at home and only eating it rarely when it was provided in group settings. He just did not know what might happen: "who knows what other adverse effects. You might end up in a wheel chair or something, or bum liver or something. Kidney failure, who knows, what's in this stuff." Others said fish was very healthy, and should be a mainstay of their diet. As one woman said, "I love the taste...I won't ever give up fish. Ever. The omega-3 and all that. It's the best thing for you." Another man even described wanting to convert non-fish eaters to eating fish: "I wish I could have them to my house and prepare fish for them. And let them know there's a world of difference between what they have grown up on."

Evangelists typically emphasized the core representations that supported their

fish-eating behaviors and then briefly mentioned additional representations when the interviewer probed for either additional potential health benefits or health risks. While they were aware of the other elements in the set of available social representations, they did not contemplate the full range of representational concepts like some other types of participants.

Evangelists often described being aware of their more extreme position– with one stating "I dare to do what I'm doing, and they don't agree with it." However, each person had sources of support for evangelism about their position. For example, one woman cited her doctor as someone telling her "whatever you do, don't give up the fish." Media also provided ideas and social representations. One man said that his ideas came from the media he was consuming, and one woman described herself as reading "a lot of health oriented stuff" and "of course they're gonna agree that fish is good." Sources like these provided curated information that supported the anchoring of the type of social representations with which each individual was most involved.

Safeguarded. A few participants knew about the positive and negative representations of fish, but had a low level of concern when it came to the negative representations. They reported they did not need to be concerned because they were protected. Some placed faith in companies or retailers while others trusted government agencies. As one woman said, "I figure that if the Food and Drug Administration doesn't say that they can't be sold, that it is probably pretty safe." Participants said that the infrastructure and regulation was sufficient to manage any potential harm on their behalf, and that it "wouldn't be in the can on the shelves in the supermarket" if there was a concern. They chose food based on their taste preferences and other constraints, like budget.

Those using the Safeguarded pattern of involvement were less actively objectifying and anchoring the negative social representations. For them, there were vague and remote risks that they did not need to contemplate, discuss, or incorporate into their food choices. They were actively anchoring fish to nutrition-related key words as a healthy food– calling it "Nutritious. Nutrient dense. Heart healthy."–while dismissing social representations about production methods, pollutants, and other topics as something that "doesn't concern me."

Oblivious. The Oblivious participants could state social representations about fish, particularly core social representations, but then dismissed them, sometimes as "hype." A typical response was "You mean like mercury poisoning and all that stuff? I don't pay any attention... I'm not going to pay attention to if you eat farm-raised salmon." These willfully oblivious participants had other priorities, and little faith in the health and media coverage of fish and nutrition-related topics. Those following an Oblivious pattern chose to avoid involvement with the positive and the negative social representations of fish–particularly in terms of potential health risks–and focused on eating according to their personal priorities, such as taste preferences and convenience. As one participant said, "Well, I read, and watch the news but I don't pay much attention to fish because I know how I want it." Those using the Oblivious pattern did not feel protected, or at low risk from mercury or other issues; they instead ignored the topics entirely and chose to focus on other aspects of fish.

Despite their lower level of involvement with the topic, anchoring of social representations of fish and seafood was still occurring among those in the Oblivious pattern. For them, pollution was often initially discussed as sewage as an anchor rather than industrial or heavy metal contaminants. Clean water was

viewed as water that was clear, or deep, rather than water that had sewage or mud in it. They mentioned health benefits, but with minimal confidence. As one woman said, "I've always heard that it is [pretty good for you], and I don't know why not. I mean, it doesn't have all the crap in it." For her, fish was lightly anchored to health, but fish was more important as a way to connect with family during special occasions, such as a specific appetizer at Thanksgiving.

Risk Managers. Risk Managers typically described a wide set of core and peripheral social representations with little prompting. They often expressed a high levels of concern along with appreciation for health benefits. The Risk Managers considered both risks and benefits of eating fish and seafood and worked to find strategies that allowed them to feel comfortable with a level of risk in relation to the benefits. They viewed eating fish as an active, complex choice that they had the agency and responsibility for figuring out. They said they had to be "skeptical." As one woman said: "I want to know what I'm putting in my mouth. You know, I, I want some assurance. Sure, everybody can lie to me. I know that. But I have to try to, you know, sift it out, some way." Some participants worried about mercury and heavy metals while others were more concerned about cleanliness and food safety. Approaches for managing risk were varied, and depended on the concern.

Risk Managers had strategies and specific tactics for implementing their strategies that allowed them to feel safe, or "trust" their sources. One strategy was focused on limiting the frequency of consumption. Specific tactics focused on frequency included using number of times per week, evaluating a whole diet, and considering how often they were eating fish from a specific water body. One woman enjoyed fish, but said that she had heard "watch your mercury, you

know, watch how much fish youre having because of the mercury" so she only ate tuna once a week instead of twice a week. Limiting quantity allowed her to enjoy it while feeling safe enough to "keep eating it" and feel like "hopefully it's not going to cause any damage." Another woman described feeling like she "might as well eat a little healthier [by eating fish] than worry about the side effects" of potential contaminants because she was not making a "seven day a week diet of it." For her, variety in diet ensured that the health benefits of eating fish would outweigh any potential risks from mercury or other pollutants. Another man, who had consciously decreased his fish consumption in recent years due to concerns about contaminants, felt that traveling for work allowed him to "get away with" eating more fish because he was not "eating from the same source all the time."

Another strategy described by some Risk Managers was focused on purchasing low risk fish. Specific tactics included avoiding selected species, using advisory lists from different organizations, choosing to eat smaller fish species, and choosing a retailer or brand who was trusted to select safer fish. These tactics were used to reduce exposure to a particular pollutant. Swordfish, for example, was avoided by some participants. Having a relationship with a trusted retailer or certain brand helped Risk Managers feel confidence in the safety of the product. As one woman said: "I can't say I did my research like how many parts per unit of mercury is in this, maybe it's only a little bit different. But I trust it, you know, low source, lower in mercury so we'll get that."

Unlike some other patterns, Risk Managers were actively anchoring these social representations of fish to both positive and negative concepts. They were seeking information about safe choices–simultaneously using "those cards that

talk about like which ones are safe" to make safety in purchasing fish concrete while also trying to eat fish twice a week for heart health and weight control. They were absorbing messages about potential harm and potential benefits and working to integrate them into their individual sets of representations as well as their food choices.

2.4.4 Involvement patterns: Dynamic individual responses to social representations

Involvement patterns are the interactions that participants described having with positive and negative social representations when it came to making their own food choices around fish and seafood. Four involvement patterns emerged with differing characteristics in terms of two dimensions: 1) their active engagement with social representations and 2) their level of certainty in social representations (Figure 2). Some participants followed the Evangelist pattern; many followed the Risk Manager pattern; some followed the Oblivious pattern; only a few participants followed the Safeguarded pattern.

In relation to each pattern, the Evangelists were the most active, emotional, confident, and committed to their path of fish-eating. A few individual followed an Evangelist pattern in favor of eating fish and a few more followed it in opposition to eating fish in this sample. They had developed an agentic, involved position in relation to the social representations and become deeply vested in following it, often after a single exposure that placed them on a path of commitment. In contrast, the Risk Managers were open to modifying the ways they ate fish and seafood in response to new information: they discussed thinking

about issues and actively working to minimize their concerns while still trying to gain the benefits of eating fish and seafood. The Risk Manager patten was the most commonly followed pattern in this sample. The Safeguarded and Oblivious effectively had the same passive approach to social representations but their underlying certainty was very different. The Oblivious ignored many social representations as irrelevant, where they were "not gonna let a little bit of that worry me," in some cases because you "gotta die of something." They were uncertain about the risks, and uncertain about the potential benefits. Some individuals were following the Oblivious pattern in this sample. In contrast, the Safeguarded were confident in their safety. This made the Safeguarded unique– no other group described feeling so confident in the ability of the food system infrastructure to protect them. The Safeguarded pattern was rare in this sample, with only a few people following it.

Involvement patterns were not static: they overlapped and evolved over time. While one involvement pattern was typically dominant, many people also incorporated aspects of other patterns. For example, someone with a Safeguarded pattern used a Risk Manager approach when asking about the lake where a fish being given to them had been caught (several lakes in the study area are highly contaminated, while others are low in contaminants). Individuals also described shifting attitudes and behaviors over time. As one current Risk Manager said, "with fish, it used to be 'Eat lots of fish! Eat lots of fish.' And I've just been tempering it because of concerns...within the last five years." He initially described following an Evangelist pattern dedicated to eating fish for health but later became a Risk Manager as the increasing discourses around the risk of pollutants in fish and seafood increased his awareness of social representations related to the negative health effects of eating fish. These overlaps in approaches

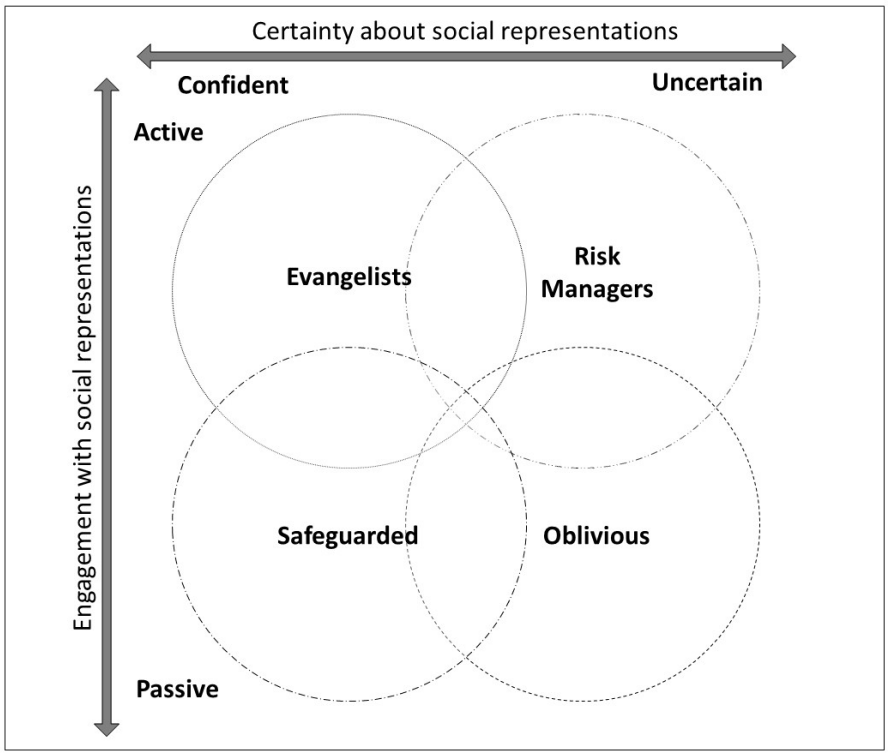


Figure 2.2: Selected characteristics of how individuals using involvement patterns interact with health-related social representations about fish and seafood

across patterns and shifts between patterns reflect both the dynamics of social representations over time and the changing individual responses to social representations.

2.5 Conclusions

Social representations of fish and seafood held by midlife rural adults included positive and negative health effects. All participants described core social representations related to the health effects of eating fish and seafood, including that fish was good for you or a healthy food, a source of omega-3 fatty acids, heart healthy, and bad for you as a source of mercury or other pollutants. Descrip-

tions related to the health effects of fish and seafood varied when participants began to discuss more detailed concepts, contributing to less-widely shared peripheral social representations. These peripheral representations allow for individual incorporation of many different understandings and ideas into personal cognitive structures in addition to the widely shared core social representations. In respect to fish and seafood, the complexity of the topic and communications about the topic produces a rich set of peripheral concepts related to health benefits and risks.

Finally, social representations are understandings that guide the individuals connections to their physical and social world (Wagner and Hayes, 2005, 244). In studying those related to food and eating, it is important to consider heterogeneity in individual responses to the same shared social representations. In this sample, a variety of patterns of involvement with social representations were identified. Some involvement patterns suggested little influence of social representations on food choice while others suggested a higher influence on food choice. Involvement patterns were not mutually exclusive, with participants describing using different patterns across time or shifting between patterns in different contexts.

2.6 Discussion

This research adds to our knowledge about how consumers interact with health-related information through the use of social representations theory in a real world context. Unlike information based on individual rational choice models (Joffe, 2003), social representations theory recognizes the role of shared "com-

mon sense" understandings as well as providing explanations for the processes by which it develops from expert knowledge (Wagner et al., 1999). This is particularly relevant for topics like nutrition and fish which are dynamic in the rate at which new scientific studies and state-promoted nutrition-related guidelines are issued. New information about fish and seafood is constantly being communicated to the public, often by the popular media and word-of-mouth, as well as governmental agencies and advisory committees. Social representations theory integrates the evolution of concepts as the intra-individual level of thought converges and diverges with the inter-individual and media-promoted representations (Joffe, 2003). Furthermore, these findings provide new insights about the thoughts and feelings that consumers retain beyond the point of purchase or moment of health communication messaging.

We propose the concept of involvement with food-related social representations, and are not aware of other studies that consider this. The concept of involvement bridges the distance between what we know and what we do. Social representations, as a shared form of knowledge, are social structures that have the potential to support or constrain individual agency. Developing an understanding of how social representations are managed by individuals through involvement adds to our knowledge of how people deal with conflicting health-related social representations. Identifying and defining involvement patterns may be helpful in terms of targeting policies or communication about fish and other topics: different patterns may benefit from different types of communication. In Figure 2.2, some patterns may benefit from effort to increase consumer engagement while others may benefit from efforts to increase consumer confidence. The concept of involvement also contributes a useful way to explain how individual consumers interact with social structures such as governments that

develop policies and corporations that engage in marketing.

These results are consistent with and expand on the findings of some prior studies examining fish consumption and health benefits and risks. As reported in a survey of Americans who were classified as not at-risk or at-risk, both positive ("healthy") and negative ("harmful") attitudes were simultaneously held by many participants (Hughner et al., 2009). Other studies also report consumers had poor recall of specific guidelines such as fish species to avoid or minimize due to mercury (Marette, Roosen, & Blanchemanche, 2008). Similar to these findings about omega-3 fatty acids, consumers have previously been shown to have a weak understanding of technical definitions of nutrition terms like calories, sodium, and fatty acids and the relationships between them (Cowburn & Stockley, 2005) and health claims (Nocella & Kennedy, 2012). Even those who might be expected to have greater confidence with information about fish and seafood, such as health care providers, are unclear about fish and seafood and health risks versus benefits (Hicks, Pivarnik, Richard, Gable, & Morrissey, 2013).

While this research did not seek to compare individual and shared understandings of terms to scientific definitions, it found that terms about fish and seafood underwent the processes of anchoring and objectification (Moscovici, 2001), creating popular understandings of terms that often differed from scientific definitions. For some, lack of understanding of scientific processes and terms discussed in the media led to substantial uncertainty when it came to evaluating what to eat.

Selecting midlife adults as a sample for this study offers unique insight into a group receiving conflicting health-related messages about fish and seafood but to whom a prevalent message related to pregnancy and breastfeeding and fish

intake likely does not apply. Conducting interviews among people living in rural areas also offers insights into the food system in multiple ways: rural areas may be more poorly served by retail grocers and people may have greater access to home or locally grown or caught foods, including fish. Strengths of the data collection methods included using open-ended, flexible interviews that allowed participants to extensively share their understandings of the health-related social representations related to fish and seafood they held. The interview method utilized probes and member checks to reduce the risk of interpretation bias (Charmaz, 2006). In addition, dependability of the analysis was enhanced through peer debriefing and double-coding for conceptual consistency with a second coder (Miles & Huberman, 1994).

A number of limitations apply to this study. Generalizability is limited, as this study was done with a small age-based sample in a limited geographic area. Older, younger, urban, non-white, and non-US individuals may hold different sets of health-related social representations in terms of fish and seafood consumption and have other patterns of involvement with them. In addition, this study conducted interviews at one time point which did not include peak fishing season in the area, limiting generalizability throughout the year. Other concerns may be more prominent during fishing season. The interview method used here, while in-depth, was potentially vulnerable to self-report and social desirability biases. All dietary information was collected through two non-quantitative food frequency intake questions and narrative reports; more precise dietary intake information could have been collected through other methods.

Additional research is needed to further develop this work among larger and

more diverse populations. Larger surveys could reach a broader population while assessing selected social representations and involvement patterns. Targeted research projects could examine pollutants more relevant to specific geographic areas. Future projects could develop an understanding of the social representations of health-related risks and benefits of eating different foods that have been subject to shifting dietary advice, such as eggs, coffee, red meat, and others. Specific questions could delve into topics related to production methods, such as different aquaculture techniques. Prospective longitudinal research designs would be particularly valuable in terms of revealing more information about the dynamics of evolving social representations and how individual involvement with them may change over time.

These early findings suggest there is a need for public health communication and policymaker action about fish and seafood topics to support consumer education. The prominence of mercury in the social representation set of individuals not targeted by recommendations to limit fish is concerning, and suggests a need for cautious distribution of messaging related to limiting fish and seafood consumption. In addition, as Thilsted et al. (2016) states, further work is needed to understand the breadth of consumers' cultural preferences and practices in different contexts and how they affect fisheries-related policies. Policymakers, regulators, and food system experts may find working to decrease the uncertainty consumers feel about fish and seafood recommendations increases confidence in fish as a safe and healthful food and its consumption. Those who write regulations and make recommendations related to fish and seafood production and consumption to support public health should consider how their recommendations connect to existing social representations, and how changes in aquaculture may be received by the public. Decreasing conflict about health-

related social representations may help people feel more comfortable eating fish and seafood at the recommended levels. Policymakers and regulators can take actions that increase confidence in the food safety and regulatory framework around fish and seafood and improve current social representations of fish and seafood safety.

CHAPTER 3

TYPES AND CHARACTERISTICS OF FISH AND SEAFOOD PROVISIONING SCRIPTS USED BY RURAL MIDLIFE ADULTS

3.1 Introduction

The United States Dietary Guidelines recommends eating eight or more ounces of fish and seafood per week because they are a rich source of nutrients, notably the fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Sufficient EPA and DHA intake is protective against a variety of illnesses, including cardiovascular disease, mild cognitive impairment, and some psychiatric conditions (Freeman et al., 2006; Kris-Etherton et al., 2002; Vannice & Rasmussen, 2014; Zhang et al., 2016). Yet less than one-quarter of adults in the US met the minimum recommendation of eight ounces of fish and seafood per week (Rehm et al., 2016). The gap between intake and recommendations suggests a need for research and intervention. Constructivist psychology offers concepts for understanding ideas and behaviors related to routine choices. This analysis will examine how scripts, sets of procedural steps (Mandler, 1984), are used as cognitive tools in provisioning fish in rural areas.

In rural food environments, limited commercial infrastructure may exist alongside a plethora of natural resources. Rural areas have higher food prices, fewer healthy food options, and lower access to full-service supermarkets (Hendrickson, Smith, & Eikenberry, 2006; Lenardson, Hansen, & Hartley, 2015; Kaufman, 1999; Gantner et al., 2011). However, some rural adults engage in activities that may provide their own food, including gardening, raising livestock for home consumption, hunting, and fishing (Morton et al., 2008; Buck-

McFadyen, 2015). These conditions suggest that rural areas are unique settings for fish and seafood provisioning (which includes acquisition, preparation, and eating out).

Midlife adults are positioned to benefit from preventive health behaviors, such as eating fish, that are associated with better cognitive and physical health outcomes. Midlife adults report increasing their effort dedicated to health-related behaviors (both managing chronic conditions and preventative behaviors) (Lachman, 2004). Furthermore, midlife adults often experience family, career, and health-related changes like retirement or altered family roles (Lachman, 2004) that offer opportunities for dietary changes. In the US, the fish consumption of groups who may be at high risk from seafood contaminants have been examined, like anglers (Lachman, 2004) or pregnant women (Oken et al., 2008), and using descriptive analysis of national dietary intake data (Rehm et al., 2016). However, gaps remain in knowledge of routine decisions and behaviors related to fish provisioning. The fish consumption and provisioning of midlife adults has not been studied in detail although they may be positioned to both benefit and take action using cognitive skills, including adaptive strategies and planning skills (Lachman, 2004).

Individual cognitive processes involved in seafood provisioning have been neglected in scientific investigations in the US, although they have been studied in Europe and Australia (Pieniak et al., 2008; Birch & Lawley, 2012; Perrea, Bruns, Altintzoglou, Einarsdottir, & Luten, 2012). Cognitive processes develop within the context of a broader culture so some components may be universal while others may be culture-specific. Outside the US, research has found that seafood consumption is affected by selection and preparation knowledge (Birch & Law-

ley, 2012; Brunso, Verbeke, Olsen, & Jeppesen, 2009; Verbeke & Vackier, 2005), household and personal taste preferences (Birch & Lawley, 2012; Verbeke & Vackier, 2005), food safety concerns (Lincoln et al., 2010), and taste or texture dislikes (Brunso et al., 2009; Verbeke & Vackier, 2005). Convenience, habit, store availability, health concerns, and pleasure were reported to be associated with fish provisioning in other nations (Pieniak et al., 2008). One approach to organizing cognitive factors uses the concept of scripts.

A script describes knowledge as a set of ordered or unordered procedural steps that provide predictability and simplifies decision making (Mandler, 1984). Frequently practiced scripts may become automatic (Mandler, 1984). Scripts are primed (initiated) when the context suggests the script is appropriate. Sets of scripts create a script repertoire from which an individual accesses the desired script when it is needed. Script repertoires have different types of characteristics, including scope, flexibility, and complexity. Scope describes the length, or the number of steps from beginning to end, in an individual script (Blake et al., 2008). Scripts with more steps have a broader scope. Flexibility describes the alternate options, or the variations available within a set of scripts (Blake et al., 2008). A script repertoire with many initial options or with individual scripts that branch into multiple options is more flexible. Complexity describes script repertoires with paths between individual scripts that allow transfer from one script to another. In other words, more complex script repertoires have many connections between individual scripts and steps that are used in different scripts.

The purposes of this study are to: first, examine the fish and seafood provisioning scripts held by rural midlife adults; second, identify the values leading to

the construction of fish and seafood provisioning scripts; and third, develop an understanding of how script scope, flexibility, and complexity relate to fish and seafood choice.

3.2 Methods

Recruitment. Participants were recruited between July 2014 and March 2015 from three rural New York counties using ads and flyers. Eligibility criteria included being 50-70 years old, having eaten fish or seafood in the past year, preparing >50 percent of meals eaten at home, and having no severe illness preventing food consumption or consent (i.e. dependence on tube feeding, dementia). Purposeful sampling was used to seek participants with varied fish-related experiences (consumption frequency, preparation frequency, and degree of preference). A total of 31 participants were recruited, which is congruent with most in-depth interview study sample sizes (Sobal, 2001). Upon reviewing the interview transcripts and field notes, the authors judged that sufficient data saturation (Charmaz, 2006) in study topics appeared to have been met and ended recruitment.

Study Design and Data Collection. A cross-sectional design was used. Each participant completed a brief form to collect personal characteristics prior to engaging in an in-depth interview. One interviewer conducted all interviews and took brief field notes afterwards. The interviews followed a semi-structured interview guide using questions related to fish procurement (locations, preferences, barriers, supports for different items), preparation (what, when, how, why different items were prepared), and topics known to influence food choice (cook-

ing experiences, cultural background, upbringing and more). Most interviews lasted about 40 minutes and included probing and member checks (Charmaz, 2006). All interviews were audio-recorded and transcribed verbatim. Participants provided written informed consent and received a small honorarium. The Cornell University Institutional Review Board approved the research protocol.

Analysis. Analysis was guided by a grounded theory approach that identified themes and processes (Charmaz, 2006). The research team discussed the field notes and transcripts to identify emergent themes and processes as the data were collected. A codebook was developed using a focus on script processes to label the concepts identified in the data. Transcripts were iteratively coded in Atlas.ti 7.1 software using a constant comparative approach, with each transcript reviewed for concepts that also emerged in later transcripts (Charmaz, 2006). A second experienced qualitative coder previously trained in the iterative research process (and trained for this project through discussion of the research questions, interview guide, a sample interview, and code definitions) coded five randomly-selected interviews with discussion of coding decisions after interviews one, three and five to confirm conceptual consistency. Throughout the analytical process, relationships between the concepts and themes were discussed by the research team and developed (Charmaz, 2006; Miles & Huberman, 1994). Emergent concepts and themes were then compared to existing script theory. Script diagrams (Blake et al., 2008) were prepared describing each participant's scripts for acquisition, preparation, and eating out. The scripts were discussed, revised, and compared. The emergent types of scripts were labeled. Script characteristics of scope, flexibility, and complexity were also examined. Peer debriefings and an audit trail were used to enhance credibility (Charmaz, 2006; Miles & Huberman, 1994).

Table 3.1: Participant Characteristics

Characteristic	*n*
Age	
51-55	5
56-60	8
61-65	9
66-70	9
Gender	
Women	20
Men	11
Race/ethnicity	
White/caucasian	30
White Hispanic	1
Employment	
Full-time	12
Part-time	6
Retired	11
Other	2
Household type	
Lives alone	11
Lives with a spouse	12
Lives with family	7
Other	1
Education level	
High school graduate/GED	3
Some college	10
College degree (2 or 4 year)	10
Graduate/professional degree	8
Subjective financial status	
Cannot make ends meet	1
Have to cut back	1
Enough but no extras	8
Comfortable with extras	20
Prefer not to say	1

3.3 Results: Participant characteristics

Participant characteristics are reported in table 3.1. The sample was diverse in terms of age, gender, employment status, household type, and education level.

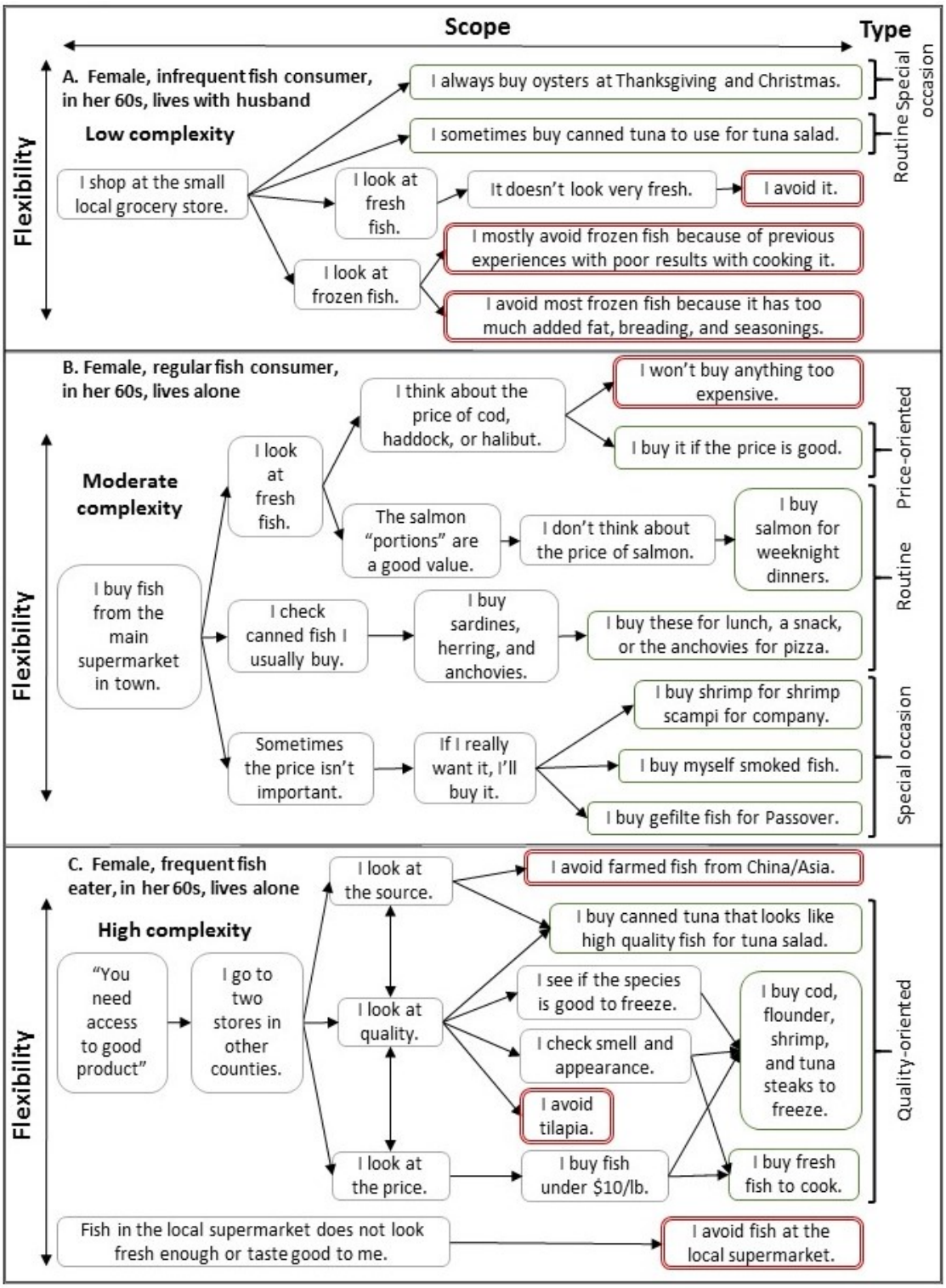
3.4 Results: Script characteristics

Acquisition, preparation, and eating out emerged as the most widely considered stages of food provisioning in this data. Analysis revealed several fish and seafood script types for acquisition, preparation, and eating out, with varying script characteristics of scope, flexibility and complexity. These are presented below.

Acquisition. Four major acquisition script types emerged in the analysis: quality-oriented, price-oriented, routine, and special occasion. Each major script type is illustrated in Figure 3.1. One other script type, fresh catch, was rarely used among this sample; some participants described it but then stated they had not used the script for years.

Quality-oriented scripts often relied on building trust with distant fish markets or grocery stores, often in other counties or 30 or more miles away. Developing a relationship with that retailer allowed shoppers to have faith that the product sold to them would meet their standards in terms of freshness, truth in labeling, production methods, and flavor (Figure 3.1, case C). In these scripts, the "main concern is to find good quality seafood." A quality-oriented script could not be replaced with other script types, and participants would most forgo fish rather than compromise quality. Another participant who shopped at a market out of his county said of local stores, "it just does not look right, smell right, doesn't feel right." Many scripts considered taste the key marker of quality, although some quality-oriented scripts incorporated health and food safety. One woman contrasted her expectations with the fish at her local grocery store, saying, "I just look at those square frozen haddock slabs... [laugh]... behind the glass doors

Figure 3.1: Acquisition script repertoires of three midlife adults



"=" outlines indicate avoidance; "-" outlines indicate indicate acquisition.

and I can't bring myself to. Not when you've had fresh fish." Cost was often mentioned as a potential constraint that limited how often a quality-oriented script was used, but did not lead to avoidance of fish.

A challenge in quality-oriented scripts was the travel distance required to reach the desired items. Some scripts included buying fresh fish suitable for freezing in bulk at home (Figure 3.1, case C), or mail ordering fish. Other scripts were primed by appointments in larger cities as a time to "stop and pick up a couple, 6 oz, 5 or 6 oz salmon portions and cook them tonight." Quality-oriented scripts for canned items, such as low mercury canned tuna, were also initiated by trips that took the participant past a retailer outside of their local shopping routes. Fish sources were often out of the county and even out of the state.

Price-oriented scripts were shaped by concern about cost. As one woman (who liked fish) said, "my pocketbook controls a lot of my decision making." Cost was the most important value in price-oriented scripts; values like quality and health were less prominent in these scripts. Sales or a sense of value primed the use of price-oriented scripts. One man described when he would buy oysters: "Buy one get two free sometimes at [store name]. So I always watch for that in the paper." Price-oriented scripts usually led to less variety in purchases than other script types. Participants who had repertoires including multiple acquisition script types described initiating price-oriented scripts where the price varied, as when market pricing was used, or in specific stores.

Routine scripts described fish and seafood bought regularly, often with weekly or monthly groceries at a supermarket, discount market, or membership bulk store. Health was often important in routine scripts; quality and cost were secondary values for some. Participants prioritized eating fish often because they

considered it healthful or "good for you." For example, they sought fish high in omega-3 fatty acids but also evaluated prices at different stores to find an affordable option. Routine scripts leading to canned or frozen fish selections sometimes incorporated freshness or quality using simpler criteria than those in quality-oriented scripts (Figure 3.1, cases A and B). Quality in this script was discussed as the production method, location, or brand instead of freshness. Most routine scripts did not lead to fresh fish, with a few exceptions. Routine scripts were repeated often; values were no longer as explicitly evaluated with each individual purchase.

Special occasion scripts described selecting and purchasing food associated with holidays, birthdays, or for guests. Often, quality was the key value influencing the special occasion script. One woman spoke of buying a specific type of shrimp at Christmas, excusing the price because they were hosting visitors and celebrating. Because the purchase was infrequent compared to routine scripts, health and cost was less important than maintaining the relationships or identity tied to the occasion, like eating gefilte fish at Passover (Figure 3.1, case B).

Fresh catch scripts were usually appreciated but rarely used. Two versions of the script were described: first, a member of the household caught fish to prepare for a meal; second, a friend or neighbor would give freshly caught fish -"a piece of trout"- to the participant as a way of sharing their catch. While most participants who described this script considered the truly fresh fish a luxury, a few described being wary of fish gifts because they were not familiar with the status of local waters and would not be comfortable eating that fish.

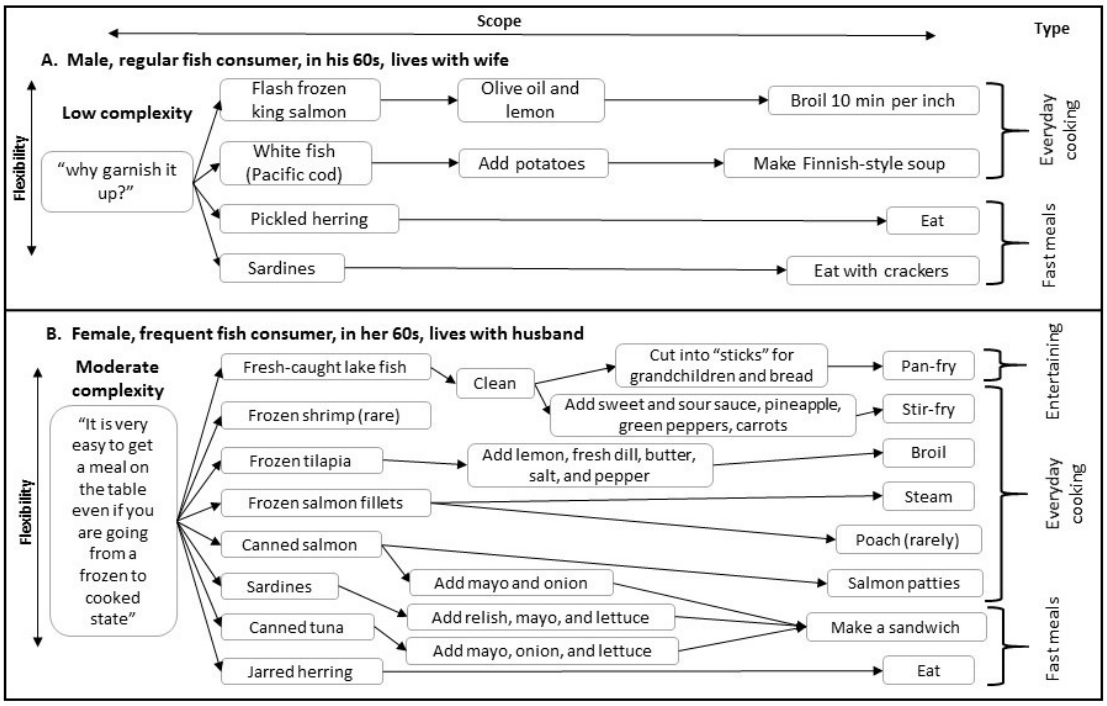
Scope of acquisition scripts reflected the values participants engaged while buy-

ing fish. Low fish consumers' scripts often had narrow scopes while more regular fish consumers' scripts usually had wider scopes. Both routine purchasing scripts and quality-oriented scripts incorporated multiple stores and values like production method, taste, and health. Price-oriented scripts often incorporated a minimum quality standard and quality-oriented scripts incorporated a maximum price, as case C (Figure 3.1) did with her $10/lb rule.

Flexibility in acquisition script repertoires reflected both the number of retail outlets and the variety of foods selected by the participant. The least flexible scripts were generally seen among the price-oriented shoppers who ate little fish: they bought the same item or two at a local store with one consideration (cost). Cases in Figure 3.1 show scripts with varying flexibility. Both quality-oriented scripts, incorporating several retailers and types of fish, and frequent fish consumption contributed to more flexible acquisition script repertoires.

Complexity in acquisition script repertoires was displayed most clearly when consumers described incorporating multiple values in fish choices. For example, one woman firmly identified herself as an "environmentalist" and strongly connected her fish purchasing scripts to that identity, although she was also concerned about personal health. Quality, cost, taste, and health were strongly considered but occasionally conflicting influences on acquisition scripts. Conflicting values had to be balanced, as when financial constraints limited pursuit of taste preferences. Participants described their fish acquisition values as emerging from their identities, life experiences, and circumstances. Quality was a common value in conflict with life circumstances: rural residence limited access to nearby supermarkets with limited affordable fish produced in the desired manner that was also perceived to be fresh enough. Consumers who consid-

Figure 3.2: Preparation script repertoires of two midlife adults



ered more values while selecting fish and seafood had more complex scripts. In Figure 3.1, script repertoires with varying complexity are presented.

Preparation. Four fish and seafood preparation script types emerged: everyday cooking, fast meal, entertaining, and grilling. Two cases are presented in Figure 3.2.

Everyday cooking scripts were described as ”easy” meals, often initiated after a work day. Many participants started with a plain fresh or frozen raw piece of fish, defrosted it if needed, seasoned it, and then cooked it simply by broiling or baking. A few participants baked frozen breaded items for this meal. Sometimes, availability of fish primed everyday cooking scripts, with one person stating: ”if I don't have good product I'm not doing it.” Health consciousness also primed this script, with those who felt strongly about eating fish initiating

everyday cooking scripts frequently.

Fast meal scripts were less time consuming than everyday cooking scripts. The main value influencing script construction was convenience involving minimal time expenditure. One woman was retired and no longer wanted to cook, so she used frozen breaded fish. Another woman said, "just, you know, put it [fish] under the broiler and turn it once and done." These scripts worked with food from the pantry or freezer, like frozen shrimp or canned tuna: "having canned tuna always on hand is, you know, for a Sunday afternoon tuna melt, or something, is convenient." These scripts were generally used when other activities were prioritized over cooking.

Entertaining scripts usually involved cooking for guests, such as birthday meals, holidays, and weekend meals. Pleasing guests and following traditions were key relationship values leading to the construction of these entertaining scripts. One man described serving shrimp for his daughter's family, saying "they're very much shrimp lovers... they love to come and see dad because they wonder what I'll cook." Another man described getting together with his brothers on a weekend afternoon and having "pepperoni and shrimp and all that stuff," especially "if there's a game on." Culture also shaped entertaining scripts, such as when one Italian-American man said, "The Christmas celebration is, you know, the seven fishes. We don't quite make it to all seven fishes, but we get pretty close."

Grilling scripts were primed by the season and type of fish. Nice weather made it possible to grill outside. Sturdier fish like whole fish, salmon, and swordfish were often used in grilling scripts, but one participant described having a fish-specific grill pan that made grilling more delicate fish easier. One woman

described how she prepared the "treat" of grilled fresh caught lake trout given to her by neighbors: "Put that [trout] in tin foil. Throw some dill on it, and put a little butter in there and put that on the grill. Oh, yummy!" Taste was a key value considered in selecting a grilling script, but grilling outside also kept the smell of cooking fish out of the house.

Scope of preparation scripts varied from one or two steps to those involving multiple preparation methods. A narrow script scope was: 1) Open can of sardines 2) Eat with crackers. A broad script scope was: 1) Catch fish 2) Clean fish 3) Chop vegetables 4) Fillet and slice fish 5) Stir-fry fish and vegetables in sauce. Preparation script scope was often implied-particularly for common dishes like tuna salad-when participants skipped stating steps. Everyday cooking and fast meal scripts generally had narrower scopes than entertaining scripts. Grilling scripts varied in scope.

Within an individual's repertoire of preparation scripts, scope often reflected their food preparation identity. Simple cooks or those who said they were uninterested in cooking generally described script repertoires with narrow scopes. In contrast, "foodies" or those who took pride in cooking for others often had both scripts with narrow scopes (for everyday cooking) and broad scopes (for entertaining) in their repertoire. One foodie, for example, described an intricate stuffed lobster recipe he made for guests on a holiday.

Flexibility in preparation script repertoires presented as use of many varieties of fish and seafood. A few participants exhibited flexibility by preparing one species many ways. In Figure 3.2, case B displayed flexibility in both preparing many types of fish and also using some of them in different ways. Frequent fish cooks tended to have more flexible repertoires.

Complexity in script repertoires appeared among those with more flexible repertoires, and who were comfortable substituting foods. These experienced cooks were able and willing to interchange different types of fish into one or more preparation methods or recipes. For example, in Figure 3.2, case B described preparing multiple types of fish sandwiches where the step "Make a sandwich" was shared by three scripts. Complexity represented adapting and sharing skills using different fish and meal types.

Eating out. Five major eating out script types emerged: fish as first choice, Friday outing, convenient meal, special event, and travel meal. Examples are in Figure 3.3. Eating out fit into the participants' lives in different ways. Eating out scripts were mostly associated with pleasure, used when participants felt they could afford it financially. A few were skeptical about fish and seafood in restaurants, viewing the quality in local restaurants as suspect (Figure 3.3, case B). They did not trust the suppliers or had experienced poor preparation, which limited their script repertoire.

Fish as first choice scripts described the idea where fish was chosen whenever it was available and acceptable. Eating out primed this script. Health, taste, and trying a new dish, particularly one not prepared at home, shaped the construction of fish as first choice scripts. A variety of settings, from a fast food restaurant to "somewhere fancy," primed this script type. Case B (Figure 3.3) described a script repertoire with fish as first choice scripts in different settings, including an exception, when the option (fried) did not meet her health values.

Friday outing scripts described going out to eat where the featured meal was fried fish. The day of the week primed the script: "being in that Friday mode, where you know, you look for a fish fry." Friday outing scripts were shaped by

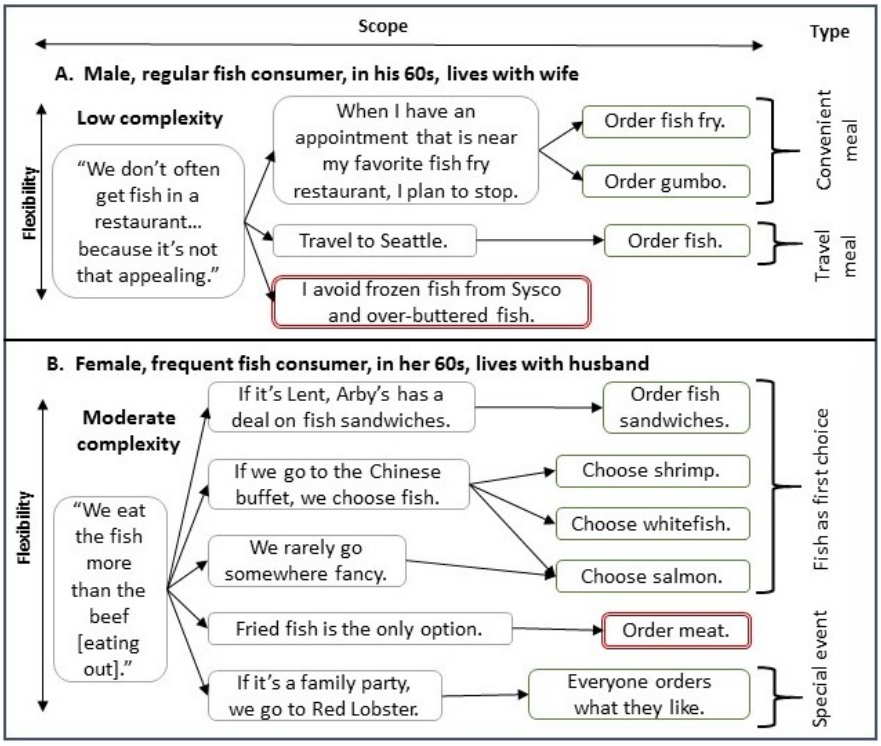


Figure 3.3: Eating out script repertoires of two midlife adults

social relationships, Catholicism, and, for some, health. Fish fry meals could be flexibly adapted by switching to healthier options, like substituting a "fish broil" or avoiding fried side dishes with their fish. The Friday outing script was an event in terms of the food, and also a time to connect to their social circle at restaurants and community sites (like volunteer fire department fundraisers).

Convenient meal scripts described quick meals integrated with other activities. Taste and convenience (especially proximity) were prioritized in these scripts. Access often primed convenient meal scripts. One traveling food truck's sign stating when it was available initiated a script: "I see the sign and mark it down, and I say, ok, and I get excited." Driving to health care appointments, shopping, and sporting events also set the stage for scripts utilizing out-of-town restaurants (Figure 3.3, case B), with participants saying they "can't go through [town]

without stopping there." Other script repertoires included multiple scripts with restaurants and fish dishes based on the season and "where we are doing our business."

Special event scripts described eating out as a way to celebrate. Family relationships shaped these scripts. Choosing restaurants where the whole family could eat was often important (Figure 3.3, case A). The circumstances initiating this type of script included birthdays, anniversaries, or Mother's Day. They were rarely used scripts, more ritualized than routine.

Travel meal scripts described eating local specialties when traveling, often for vacations but occasionally for work. Taste was typically the strongest value contributing to travel meal scripts. Travel meal scripts were both general-based on overall principles for eating-and specific to geography or restaurants. One woman described a broad travel script where she prioritized "fresh and local" seafood when they were "by a seaport or whatever, try to think what maybe they had caught that day." Others talked about specific regional scripts: "Maine is where I eat lobster. I don't really eat lobster elsewhere." For some, proximity to an ocean or a lake increased their confidence in the freshness and quality of fish and seafood. Eating out scripts' scope tended to be narrow, with a first step of deciding where to eat out and a second step of what type of dish to order.

Within this sample, participants reported a range of flexibility across their eating out script repertoires. A few people, those who ate out rarely or rarely ordered fish, had limited flexibility. Others, however, had a wider range of experiences which produced more flexible script repertoires. Those with greater flexibility tended to have more travel experiences and greater subjective financial status.

Eating out scripts showed little complexity. Modifying meals, such as substituting preparation methods or side dishes, added complexity. Health concerns motivated changes; for example, switching to broiled fish with Cajun seasoning from fried fish reduced calories and fat.

3.5 Results: Script integration

Scripts from different stages of food provisioning linked to each other, but were separated into different sets of procedures. For example, acquisition was a precursor to preparation. Eating out was an alternate script to preparation. However, the knowledge and steps taken for each of these activities was separated by both time and space.

Most participants' script repertoires included multiple scripts and different script types at each food provisioning stage; only a few participants had limited repertoires for acquisition, preparation, or eating out. Certain acquisition script types commonly led to particular preparation script types; for example, "special occasion" acquisition scripts often supplied "entertaining" preparation scripts. "Routine" acquisition scripts supplied "everyday cooking" and "fast meal" preparation scripts. In contrast, "eating out" scripts served as a substitute for "preparation" scripts. One woman described how she preferred to eat out over cooking at home.

Scope, flexibility, and complexity of script repertoires varied across each provisioning stage; however, those with more scope, flexibility, and complexity at acquisition tended toward more scope, flexibility, and complexity at preparation. Eating out script repertoire characteristics varied markedly from acquisi-

tion and preparation script repertoire characteristics and reflected financial and restaurant access more than food preparation practices.

3.6 Discussion

Scripts are a valuable conceptual tool for understanding explicit food provisioning decisions and activities along with the implicit meanings underlying them (Mandler, 1984). To the best of our knowledge, scripts have not been previously applied to multiple stages-acquisition, preparation, and consumption-of food provisioning decisions for specific foods.

Understanding the characteristics of an individual's script repertoire and the specific situations in which different types of scripts are used adds to our ability to examine personal knowledge structures and how they are applied. Furthermore, examining several stages of provisioning using types of scripts, script characteristics of scope, flexibility, and complexity, and script integration provides additional insights into understanding food choice.

Scripts (procedural knowledge) are a specific type of schema. Schema are cognitive databases of knowledge categories constructed from previous experiences. Schema are used in two ways: first, to guide behavior in familiar contexts; and second, to interpret new information quickly and easily (Mandler, 1984; Schraw, 2006). Because they are used to guide behavior in both familiar contexts and when presented with new information, schema influence food choices. Within food and nutrition research, scripts have been used to deepen understanding of several phenomena. Examples include schema and scripts for personal and family eating (Blake & Bisogni, 2003), scripts for evening meals (Blake et al.,

2008); eating scripts for dating (Amirarian & Sobal, 2009); masculinity and eating (Sobal, 2005); grocery shopping scripts (Stoltman, Tapp, & Lapidus, 1989); and scripts for using kitchen equipment (Silva, 2010).

Script construction was influenced by participant values, goals, and resources. Specific values discussed by the participants are described in the Food Choice Process Model, where values like taste, health, cost, convenience, and religion are important in food choice (Sobal & Bisogni, 2009). The fish provisioning scripts people described constructing in these rural areas were often complex, and the characteristic of script repertoire complexity was introduced to describe this. The interaction of multiple standards (like freshness, source, and cost) produced complex scripts that emphasize how multifaceted, dynamic, and complex food choice is, even for foods consumed less often. Quality-oriented scripts particularly emphasized including multiple standards. Strategies used by these participants to achieve their standards were previously identified by Birch et al (2012), including using reputable retailers, seeking information, and looking at extrinsic quality cues (i.e. labels).

This work builds a knowledge base about how midlife adults are accessing resources for fish and seafood in a rural food environment. Local grocery stores, particularly small grocers, were sometimes thought to have limited variety and poor quality fish. Fish acquisition scripts revealed how midlife adults adapted to available resources; quality-oriented scripts often included steps like traveling substantial distances to acceptable markets, buying fish in bulk, and refreezing fish at home. Eating out scripts featured other non-grocery resources, including traveling food trucks, fish fry events held by community organizations, and even a seasonal traveling truck selling raw fish to cook at home. As

a product with limited durability, fresh and frozen fish illustrate the economic, human and material capital (like travel costs, time, knowledge, and social relationships) that may be required to acquire acceptable fish.

Strengths of the project include using a qualitative interview method that collected detailed, rich information from the participants perspective. Member checks, peer review, double-coding, and an audit trail were used to enhance the trustworthiness and credibility of the findings. Some limitations are present in this study. All data was collected through self-report, so participants may have tailored their narratives to include or exclude information. In addition, while probes were used, cooking is a topic in which many steps are implied and some steps, particularly those that are nearly below the conscious level, may have been assumed. An age-based, racially homogeneous sample from a limited geographic area was used for this study so transferability of the findings is limited. Using a different sample, including urban, non-white, non-US, younger, or older individuals could lead to the discovery of other script types. Additional research is needed to understand how fish provisioning scripts may vary among groups and in different areas, including those less influenced by fishing and Catholicism, and to develop an understanding of how marital and family status influences scripts. Future understanding could be extended by using larger samples to conduct gender analysis, class analysis, and cultural analysis that considers the role of personal characteristics in food script formation and use.

3.7 Implications for research and practice

Understanding script types helps educators and public health professionals gain a view of people's perspectives about how fish and seafood provisioning fit into their lives. With this knowledge, efforts toward improving adherence to the Dietary Guidelines may be undertaken. The steps in each script provide insight into the values, procedures, and factors facilitating and limiting fish consumption script formation.

This research suggests several potential targets that could affect fish intake in rural areas, including: 1) strengthen regulation of fish and seafood safety and clearly communicating regulations to the public; 2) increase trust in retailers' fish options for individuals with quality-oriented scripts; 3) create policies that support community supported fisheries that provide freshly caught (or frozen and shipped) fish that meet consumers' quality standards; 4) develop educational programs that incorporate elements to expand cooking skills, particularly everyday cooking and fast meals scripts using frozen or canned fish that are more likely to be accessible in rural areas; 5) support the development, marketing, and selection of tasty healthful fish entrees in restaurants that fit into fish as first choice and convenient meal scripts; and 6) expand individuals' script repertoires by promoting the healthfulness of eating fish and seafood in all forms: fresh, frozen, and canned. Expanding script repertoires requires individual knowledge and skills, time to experiment, and financial resources for purchasing food, equipment for catching fish, or eating out. Establishing new scripts, whether through food system change or individual counseling with clients, that overcome gaps in local resources while incorporating social and cultural contexts may also work to decrease the gap between current fish intake and rec-

ommended fish intake by providing individuals with easy, familiar options for managing fish provisioning.

Scripts are a useful tool for interpreting research data describing culturally-embedded personal procedural knowledge related to food and eating. Research is needed to expand knowledge about all components of food provisioning, including food storage, use of leftovers, and food sharing among midlife rural adults, and different age and cultural groups. Integration of scripts for different stages of food provisioning offers an additional perspective for understanding how scripts for one activity may influence other activities.

CHAPTER 4

MIDLIFE ADULTS: ASSOCIATIONS BETWEEN SOCIAL REPRESENTATIONS, FISH PREPARATION CONFIDENCE, AND OMEGA-3 INDEX VALUES

4.1 Introduction

Fish and seafood make up a relatively small portion of the protein consumed by adults in the US (Daniel et al., 2010), but Dietary Guidelines for Americans (DGA) state that adults should eat more fish and seafood (USDA, 2015). Currently, the DGA (2015) recommends consuming 8 or more ounces per week, or approximately two servings. While some evidence suggests fish consumption may have recently increased slightly (Van Voorhees, 2015), Americans have typically only consumed about half of the recommended amount (Rehm et al., 2016). Social and contextual changes have the potential to continue to narrow this gap. The present study sought to identify whether selected social factors, including fish beliefs and practices, were associated with fish intake and its physiological outcomes among midlife adults.

Fish and seafood are animal protein sources that include fresh and saltwater fish, shellfish, and other seafood like octopus and squid. The omega-three long-chain polyunsaturated fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) found in fish and seafood offer health protective benefits (Harris, 2010). Some fish are richer than others in these fatty acids, including salmon, sardines, herring, tuna, trout, and mackerel (Cardoso et al., 2016). Currently, omega-three fatty acid status is not routinely assessed clinically (Harris, 2010). In research settings, omega-three fatty acids are assessed through a num-

ber of different methods, including plasma lipids, whole plasma, platelets, and erythrocytes (Serra-Majem, Nissensohn, Overby, & Fekete, 2012). One measure that has relationships to clinical outcomes is the omega-three index. This measure examines the sum of erythrocyte EPA and DHA, expressed as a percentage of total erythrocyte fatty acids (Harris & von Schacky, 2004). Values over 4% are considered lower risk, with 8% being a suggested target (Harris & von Schacky, 2004; McNamara, 2016). Typical omega-3 index values in the US range from 2% to over 11%, with a mean of 4.5% (Harris, Pottala, Varvel, & Borowski, 2013). One strength of this measure is stability; unlike serum or plasma values, this value reflects intake over four to six months rather than acute intake (Harris, 2010).

A higher omega-three index has been associated with improved cardiovascular and cognitive health outcomes. Men with higher omega-3 index values exhibit nearly three-quarters lower cardiovascular (CVD) risk (Albert et al., 2002); and similar findings appeared in a prospective German study of angiography patient mortality, with decreased risk associated with higher levels of erythrocyte EPA, DHA, and omega-3 index values (Kleber, Delgado, Lorkowski, Marz, & von Schacky, 2016). Individuals with higher DHA intake have a lower risk of depression (Cardoso et al., 2016), as do those with higher erythrocyte EPA and DHA levels (McNamara, 2016). Furthermore, increasing omega-3 status among depressive patients has been shown to decrease suicidality (McNamara, 2016). Individuals with higher omega-3 status also showed lower levels of cognitive decline, and less risk of developing Alzheimer's disease (Cardoso et al., 2016). Randomized controlled trials introducing DHA to healthy adults with diets low in DHA showed improved cognitive performance (Stonehouse et al., 2013). While some research suggests no effect of EPA and DHA on these health

outcomes, such as the meta-analysis conducted by Rizos (2012), adults with low initial omega-3 levels appear to benefit more consistently during interventions addressing these complex conditions.

Midlife adults are an important population to study because 1) they have substantial potential to benefit from interventions addressing conditions common to aging and 2) they offer insight into the thoughts and behaviors of people who eat more fish. Some medical conditions common to midlife include hypertension and hyperlipidemia (Lachman, 2004). Eating fish offers one way to reduce the risk of common morbidities, including depression, cognitive decline, metabolic syndrome, and CVD (Baik, Abbott, Curb, & Shin, 2010). Those conditions may be treated with lifestyle changes as well as medications, and eating fish is a part of the Mediterranean diet and the American Heart Association's diet recommendations for cardiovascular risk reduction (Mahan et al., 2012). Midlife adults are also at an age when they are becoming more aware of health risks, particularly chronic disease, and may shift toward spending more time on health-related activities (Lachman, 2004). Adults ages 50-69 eat about 15% more fish than adults ages 20-49 (Daniel et al., 2010), although they still eat less than the recommendations to maximize risk reduction. This slightly higher intake may offer more power for assessing the social and practical factors that contribute to fish consumption.

Applying evidence-based dietary recommendations in clinical and community practice requires understanding the social and practical factors affecting health-related behaviors. In the US and abroad, fish and seafood are often perceived by individuals as a healthful food (Hall & Amberg, 2013). It is promoted as healthful in dietary recommendations from federal and non-profit groups (Kris-

Etherton et al., 2002; USDA, 2015); but warnings about contaminants provide conflicting advice about limiting consumption (for example, (*Health Advice on Eating Sport Fish and Game*, 2016)). Research indicated that some consumers felt conflicted about the information they had about fish and seafood (Hall & Amberg, 2013). Even health care providers were uncertain about the recommendations for eating fish and seafood (Hicks et al., 2013). As such, fish remains a contested food: one that is simultaneously promoted as healthful by authorities while the public is also reminded about the dangers of eating fish.

The many and often conflicting ideas about a topic like fish consumption held by the population can be conceptualized as social representations. Social representations are shared ideas, thoughts, and images (Markova, 2015). Previous qualitative research, presented in Chapter 2, indicated that adults describe simultaneously holding clusters of positive and negative social representations related to the health effects of eating fish and seafood. Positive representations and negative representations were concurrently held by the same individuals about similar topics, with some specific representations being more universally shared than others. Positive social representation clusters included the health effects on specific body systems (supporting brain and heart health, improving cholesterol levels) while negative social representations included the dangers of specific environmental contaminants (mercury, PCBs) and hygienic production and handling practices. The present study will examine fish-related social representations quantitatively using a larger sample.

Fish and seafood are integrated into the American diet in many ways: from regional food specialties like gumbo or chowder to fish sticks in school lunches. Preparation practices are influenced by cultural background but guidelines also

suggest selecting methods to reduce exposure to contaminants as well as adherence to the DGA's promotion of lean protein. Previous research indicates that lower fat cooking methods (broiled or baked) led to higher omega-three values and better heart function compared to higher fat cooking methods (deep-fried) (Mozaffarian et al., 2003). Current approaches to examining fish intake only evaluate preparation to the extent that they may exclude deep-fried fish (e.g. examines consumption of "non-fried fish") but do not consider the added fat content of other cooking methods. The present study will examine a wider breadth of fish preparation practices than prior research.

Two research questions in this project examined the connections between social representations, fish-related practices, and a biological measure of omega-3 status. First, we sought to investigate whether fish-related social representations are associated with self-reported fish intake, hypothesizing that consumers who hold strong positive seafood social representations will consume more fish and seafood. Second, we sought to consider how preparation methods are associated with omega-3 status, hypothesizing that consumers who are confident about and who select fish cooking methods with little or no added omega-6 fats will have improved omega-3 index status.

4.2 Methods

Design

A cross-sectional survey was conducted using a self-administered questionnaire and researcher-administered dried blood spot (DBS) procedure.

Sample and Setting

Recruitment occurred through print and online notices, public intercepts at events such as food pantry distributions and community festivals, club and group meetings, and farmer's markets. Over 20 events and locations of varying types were attended, with the expectation of minimizing bias by recruiting participants of different ages and socioeconomic statuses. Eligibility criteria included being between ages 50 and 75 and not having a diagnosis of dementia or Alzheimer's disease. Eligibility for the DBS included being at an appropriate site (site permission, handwashing facilities, indoors) and not taking a prescription anticoagulant. Recruitment was concurrent with data collection.

Data collection took place at community sites such as public libraries, community centers, churches, events and university research rooms between June 2016 and October 2016 in five counties in New York State (volunteers residing outside those counties were also eligible). Four counties are classified by USDA as non-metropolitan and one as metropolitan, with a small city (USDA, 2013). The five counties have varied food environments, with participants frequently driving longer distances to grocery stores in some counties while not in others, as reported in Chapter 3. All counties had at least one major supermarket and access to public fishing in lakes, rivers, or ponds.

The sample size of 100 DBS was calculated for a 0.8, $p<0.05$, power to detect a 2% difference in the omega-3 index. Approximately 50% of survey participants were expected to volunteer and be eligible for the DBS. A total of 212 respondents were recruited for the survey in order to successfully collect 100 DBS complete samples. A total of 101 respondents volunteered for the DBS, and 100 blood samples were successfully collected by a trained researcher for

analysis. One fingerstick failed to elicit blood.

Measures

The survey was developed based on questions and scales used in previous research about fish or eating (Birch & Lawley, 2012; Hall & Amberg, 2013; Leek, Maddock, & Foxall, 2000; Pieniak et al., 2008; Pliner, 1994; Thorsdottir, Sveinsdottir, Jonsson, Einarsdottir, & Thorsdottir, 2012; Weinstein, 1995), cooking methods commonly used in the region for fish and seafood, and concerns related to fish identified during in-depth interviews conducted for Chapter 2 and Chapter 3. Pilot testing was conducted with a small group of 10 demographically-similar volunteers to clarify language and shorten the survey. Face validity was assessed by three experienced survey researchers.

Scales were created from Likert-type questions. The six scales, using a mean value of the items, were created and reviewed. Each scale was examined for reliability using the alpha function of the psych package (Revelle, 2016) for R, and some variables were removed to improve scale internal consistency (see Appendix 4). Mean scale values were summed and divided by the number of responses for each individual. Scale reliability for all six scales is presented in Table 4.1; all, with the exception of positive social representations (alpha = 0.68), were over 0.7, a common standard for reliability (Tavakol & Dennick, 2011).

Demographic characteristics. Age, gender, education, employment, race/ethnicity, household type, and subjective financial status were assessed. Age and race/ethnicity were open-ended questions; all others were closed-ended items.

Table 4.1: Scale Reliability

Scale concept	*Items*	*Mean (SD)*	*Cronbach's alpha (95% CI)*
Fish preference	6	3.1 (0.60)	0.80 (0.75-0.84)
Fish availability	7	3.4 (0.74)	0.82 (0.78-0.86)
Fish preparation confidence	5	3.3 (0.96)	0.84 (0.81-0.88)
Positive social representations	4	3.8 (0.69)	0.68 (0.61-0.71)
Negative social representations	4	3.3 (0.77)	0.71 (0.64-0.77)
Trust in system	2	3.1 (0.91)	0.74 (0.67-0.81)

Fish practices: preparation methods, preparation confidence, and fish taste preferences. Preparation methods were assessed using eight frequency-based closed-response questions about the previous year, which were transformed into servings per month. Individual cooking method questions were examined and then two composite values were examined, a high fat preparation summed intake (deep fried, casseroles, and prepared with mayonnaise) and a low fat preparation summed intake (baked, sauteed, steamed/boiled, soup, and other). Preparation confidence was assessed using Likert-type items adapted from in-depth interviews conducted about fish and seafood, described in Chapter 3. Fish taste preference items were adapted from the Food Neophobia Scale (Pliner, 1994). Additional details about items and scale development are available in the supplemental material.

Positive and negative social representations and trust in food system distribution. A pool of Likert-type items generated from in-depth qualitative interviews presented in Chapter 2 about fish and seafood were assembled and pilot tested to create scales assessing trust in fish and seafood food system distribution, positive social representations and negative social representations. Additional details about the items and scale development are available in the appendix.

Fish and seafood availability. A pool of Likert-type items generated from in-depth qualitative interviews presented in Chapter 2 about fish and seafood were assembled and pilot tested to create a scale assessing perceptions of fish and seafood availability. Additional details about the items and scale development are available in the appendix.

HS Omega-3 Index. The omega-3 index was assessed using a DBS collected by a trained researcher. The HS Omega-3 Index is the sum of the fraction of EPA and DHA found in the erythrocyte membrane by weight (Harris & von Schacky, 2004).

Fish and seafood intake. Fish and seafood intake was assessed through four semi-quantitative questions, previously used by Oken et al. (2008). One fish type, perch, commonly consumed in this area, was added to a question as an example of species. Responses were transformed in mean ounces per week and all fish types were summed into total fish consumption in ounces per week.

Data collection procedures

Participants either completed the survey at the time they were recruited or scheduled an appointment with the researcher. Participants completed the paper survey themselves. Participants who also volunteered for the CBC provided the blood sample at the same time the survey was conducted. A trained member of the research team used a lancet to collect one drop of blood on filter paper pretreated with an antioxidant mixture (OmegaQuant, Sioux Falls) to prevent oxidation of the fatty acids, which was then dried for 20 minutes and stored in a sealed plastic bag with desiccant. Samples were transported from field sites and

stored in a commercial freezer at -80 degrees Celsius until they were shipped to the laboratory for analysis. Volunteers received an honorarium. Written informed consent was provided. The protocol was approved by the Cornell University Institutional Review Board.

Analysis

Statistical procedures. The surveys were entered into an electronic file and 10% were verified through double entry. The data were reviewed and imported into R (R Core Team, 2016) for statistical analyses. Three surveys were removed due to age above 75 years and one due to being nearly totally incomplete. The data were examined through univariate analysis and bivariate analysis; correlation tables are reported in the appendix. Moderate correlations between some items were present.

The analysis was guided by the biopsychosocial model. The predicted outcomes of the regressions, the intake and omega-3 index, were considered to be the biological domain. Individual psychological and social aspects were entered into the regression as predictors of the biological variables. The psychological domain was represented by selected measures predicting intake, including fish taste preferences, fish preparation confidence, and agreement with positive and negative social representations. The social domain was represented by fish and seafood availability and trust in the food system.

Sequential linear regressions predicting fish intake and the omega-3 index controlled for potential confounding variables, including age, gender, education, and financial status. Total fish intake, omega-3 index, all six scales, high fat

preparation methods, low fat preparation methods, age, and education were treated as continuous variables. Gender and financial status were treated as dichotomous categorical variables, with financial status split into ”comfortable” and ”other than comfortable.” Participants with missing data for key variables were omitted from the regressions, and these omissions are reported in the results. Imputations were not performed for missing data because the frequency of excluded respondents due to missing data is below 5% (Scheffer, 2002).

Two outcomes were examined using regression models: fish intake and the omega-3 index. Two sets of regression models were run in order to examine fish intake. The first used the larger sample, including the survey only (”S”) sub-sample and the survey plus blood sub-sample (”S+B”). The second repeated those models in the S+B sub-sample. A third set of regression models examined the omega-3 index in the S+B. The omega-3 index could only be examined in the S+B. A total of 13 sequential regression models were performed in the three sets. Four sequential regression models were conducted in the S and S+B sample, predicting fish intake based on 1) participant characteristics; 2) participant characteristics and preparation confidence; 3) participant characteristics, preparation confidence and social representations (positive and negative); and 4) participant characteristics, preparation confidence, social representations, and other variables. The same sequential regression models were repeated with just the smaller S+B sub-sample, predicting fish intake based on 5) participant characteristics; 6) participant characteristics and preparation confidence; 7) participant characteristics, preparation confidence and social representations (positive and negative); 8) participant characteristics, preparation confidence, social representations, and other variables. The final five sequential regressions were conducted in the S+B sub-sample, evaluating the omega-3

index based on 9) participant characteristics; 10) participant characteristics and preparation confidence; 11) participant characteristics, preparation confidence and social representations (positive and negative); 12) participant characteristics, preparation confidence, social representations, and other variables; and 13) participant characteristics, preparation confidence, social representations, other variables, fish intake, and fish preparation practices. Variance inflation factors (VIF) were examined for collinearity; the square root of each VIF for all variables in each model was below two.

Laboratory analysis. The DBS were analyzed in one batch by OmegaQuant, a commercial laboratory with expertise in using capillary column gas chromatography to obtain fractions of fatty acids, described elsewhere (Sarter, Kelsey, Schwartz, & Harris, 2015). The laboratory has previously shown a correlation coefficient of 0.96 between red blood cells and DBS for EPA + DHA (Harris & Thomas, 2010). The laboratory coefficient of variation is 5-6% for the omega-3 index from DBS samples.

4.3 Results

Participant characteristics, findings about preparation method use, the findings about the predictors of fish intake, and the findings about predictors of the omega-3 index are reported below.

4.3.1 Descriptive analyses

Participant characteristics

Participant characteristics are presented in Table 4.2. Characteristics are reported for the full sample, participants who completed the survey and DBS (S+B), and participants who completed the survey only (S), without the DBS. There were two statistically significant differences between S+B and S participants: age was slightly higher among S+B participants and the percentage of women was higher among S+B participants. The DBS sample was approximately 6 months older and had 15% more women. No other statistically significant differences between the S and S+B participants were present.

Preparation methods

Preparation methods for fish and seafood are presented in Figure 4.1. No statistically significant differences were present between S and S+B groups. The most commonly used methods low in added fats included baking and pan-frying (sauting) while the most commonly used methods higher in added fats included preparing with mayonnaise and deep-frying. Overall, consumption of fish prepared using lower fat methods was significantly higher (4.0±3.2 servings/month) than intake of fish prepared using higher fat methods (2.2±2.0 servings/month) in this sample ($p<0.001$).

Table 4.2: Participant Characteristics by Sample

Characteristic	All participants	S+B sub-sample	S only	p-value
n	208	100	108	
Age in years, mean	62.9	63.19	62.65	0.001***
Gender				0.028*
Male	36% (74)	28% (28)	43% (46)	
Female	64% (134)	72% (72)	57% (62)	
Household size				0.234
Lives alone	31% (65)	37% (37)	26% (28)	
Lives with spouse	57% (119)	50% (50)	63% (69)	
Other	12% (24)	13% (13)	11%(11)	
Race				0.656
Native American/Native American mixed	2%(5)	3%(3)	1% (2)	
White/Caucasian	86% (178)	86% (86)	85% (92)	
Other	1% (3)	1% (1)	1% (2)	
Unstated or "human"	11% (22)	10% (10)	11% (12)	
Education level				0.172
Some middle/high school	6% (13)	9%(9)	4% (4)	
High school graduate	20%(41)	22%(22)	18% (19)	
College degree	38% (80)	40%(40)	37% (40)	
Graduate/professional degree	35% (73)	29% (29)	41%(44)	
Employment				0.093
Full-time	25% (53)	24% (24)	27% (29)	
Part-time	14% (30)	11% (11)	18% (19)	
Homemaker	4% (9)	7% (7)	2% (2)	
Retired	45% (94)	43% (43)	47% (51)	
Unemployed	3% (6)	5% (5)	1% (1)	
Other	8% (16)	10%(10)	6% (6)	
Financial situation				0.372
Comfortable with extras	48% (99)	45%(45)	50% (54)	
Comfortable, no extras	24% (49)	21%(21)	26% (28)	
Have to cut back	14% (28)	17% (17)	10% (10)	
Cannot make ends meet	6% (12)	8% (8)	4% (4)	
Prefer not to say	9% (19)	9% (9)	9% (10)	
Fish eaten (oz/week)	7.1	6.5	7.8	0.168
Omega-3 Index	N/A	4.75	N/A	

P-values marked to indicate significance: *p<0.05; **p<0.01; ***p<0.001.

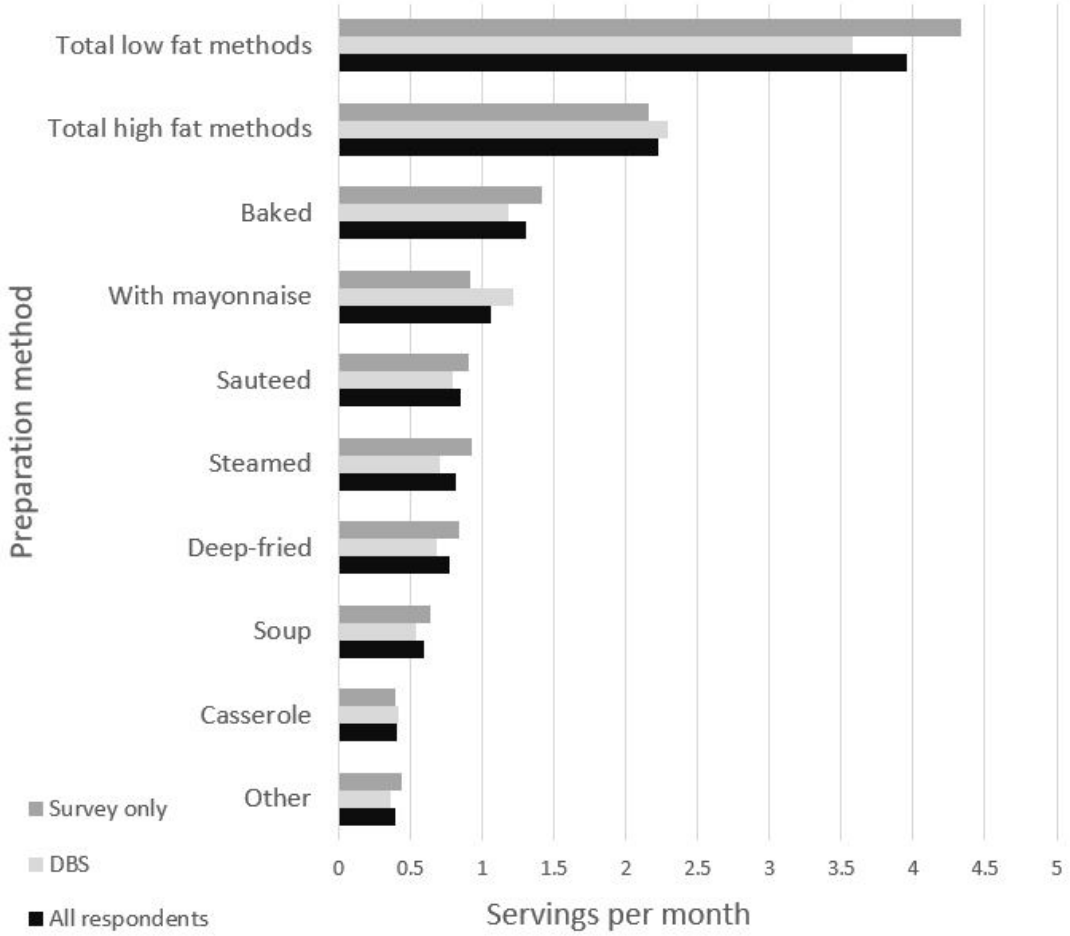


Figure 4.1: Fish preparation method frequency by midlife rural adults

4.3.2 Regression models predicting outcomes

Predictors of fish intake among S and S+B

Predictors of fish intake among all respondents are presented in Table 4.3, with regression coefficients for each variable in the table. Statistical significance is indicated by asterisks. Tables with standard errors are presented in Appendix 5. None of the participant characteristics were statistically significant in predicting fish intake in model 1. In model 2, fish preparation confidence was statis-

Table 4.3: Predictors of Fish Intake in Ounces per Week Among All Participants

	Model 1	*Model 2*	*Model 3*	*Model 4*
n = 208	204	203	203	200
Intercept	-0.43	-3.94	-6.58	-9.03
Age	0.07	0.07	0.06	0.05
Gender, female	-1.53	-1.65	-1.65	-1.39
Financial status, other than comfortable	1.77	1.75	2.28*	2.28*
Education	1.12	0.89	0.71	0.86
Fish preparation confidence	-	1.46**	0.95	0.76
Positive social representations	-	-	1.90*	1.67*
Negative social representations	-	-	-0.58	-0.23
Trust in system	-	-	-	0.91
Fish preferences	-	-	-	0.57
Fish availability	-	-	-	-0.64

Beta coefficients marked to indicate significance: *p<0.05; **p<0.01; ***p<0.001.

tically significant (p<0.01) in predicting intake, controlling for characteristics. In model 3, positive social representations and financial status were statistically significant (p<0.05) when controlling for participant characteristics, fish preparation confidence, and negative social representations. In model 4, positive social representations and financial status continued to be statistically significant (p<0.05) with scales assessing trust in fish distribution, fish taste preferences, and fish availability added to demographic characteristics, fish preparation confidence, and social representations. Fish preparation confidence was not statistically significant in model 3 or 4.

Predictors of fish intake among S+B

Regression coefficients for predictors of fish intake among the S+B sub-sample are presented in Table 4.4. Models 5-8 include the same variables as models 1-4 above, predicting fish intake in the smaller sample. In model 5, education was

Table 4.4: Predictors of Fish Intake in Ounces per Week among Midlife Rural New York Adults who Provided a DBS

	Model 5	*Model 6*	*Model 7*	*Model 8*
n = 100	100	99	99	99
Intercept	-0.12	-3.14	-8.77	-15.65
Age	0.04	0.03	0.03	0.01
Gender, female	-2.42	-2.82	-2.80	-2.12
Financial status, other than comfortable	1.83	1.62	2.15	3.07
Education	1.70*	1.40	1.23	1.50
Fish preparation confidence	-	1.59*	1.15	0.59
Positive social representations	-	-	1.38	1.44
Negative social representations	-	-	0.51	0.79
Trust in system	-	-	-	1.50
Fish preferences	-	-	-	1.16
Fish availability	-	-	-	-0.41

Beta coefficients marked to indicate significance: *p<0.05; **p<0.01; ***p<0.001.

statistically significant (p<0.05), unlike model 1. In model 6, fish preparation confidence was statistically significant (p<0.05), similar to model 2. In models 7 and 8, no variables were statistically significant.

Predictors of the omega-3 index among S+B

Predictors of the omega-3 index among the S+B sub-sample are presented in Table 4.5. Models 9-12 use the same sequential predictors as models 5-8 above, with the dependent variable changing to the omega-3 index. Model 13 adds fish intake, high fat preparation methods, and low fat preparation methods to model 12. In models 9 and 10, no variables were statistically significant. In model 11, positive social representations was statistically significant, with an increase of 0.59% in the omega-3 index for every point higher on the scale. In

Table 4.5: Predictors of the Omega-3 Index among Midlife Rural New York Adults who Provided a DBS

	Model 9	*Model 10*	*Model 11*	*Model 12*	*Model 13*
n = 100	99	98	98	98	98
Intercept	3.49	3.45**	2.05	1.20	1.69
Age	0.02	0.02	0.02	0.03	0.02
Gender, female	-0.36	-0.38	-0.40	-0.32	-0.32
Financial status, other than comfortable	-0.37	-0.40	-0.17	-0.18	-0.20
Education	0.05	0.05	0.05	-0.12	-0.18
Fish preparation confidence	-	0.06	-0.15	-0.32*	-0.35*
Positive social representations	-	-	0.59***	0.56***	0.52**
Negative social representations	-	-	-0.07	-0.08	-0.12
Trust in system	-	-	-	-0.05	0.14
Fish preferences	-	-	-	0.47**	0.46**
Fish availability	-	-	-	0.11	0.15
Fish intake	-	-	-	-	0.01
High fat preparation	-	-	-	-	0.08
Low far preparation	-	-	-	-	0.04

Beta coefficients marked to indicate significance: *p<0.05; **p<0.01; ***p<0.001.

model 12, three variables were statistically significant: fish preparation confidence (0.32% increase in the omega-3 index per one point increase in the fish preparation confidence scale), positive social representations, and fish preferences, which measures taste preferences for fish and seafood (0.47% increase in the omega-3 index per one point increase in the fish preferences scale). In model 13, fish preparation confidence, positive social representations and fish preferences remained statistically significant, with little shift in the coefficient values.

4.4 Discussion

These results provide selective support for hypothesis one proposing a relationship between social representations about fish and seafood consumption. Respondents who scored higher on positive social representations about fish and seafood reported consuming more fish and seafood. Furthermore, the predicted increase per point higher scored on the social representations scale ranged from 1.67-1.90 oz/week (models 3 and 4) is an amount relevant to dietary intake needs. The analysis of the sub-sample S+B did not find a statistically significant relationship; the sub-sample was half the size of the full sample and may have lacked enough power to detect statistical significance. However, the coefficients were, notably, a similar size. A change based on the coefficient is approximately half the gap between current intake and the DGA for adults, and could be a clinically important amount in terms of raising the omega-3 index over long-term consumption (Harris, Pottala, Sands, & Jones, 2007).

Respondents with higher positive social representation scale scores were also shown to have higher omega-3 index values in models 11, 12, and 13 (with a predicted increase of 0.5-0.6% in omega-3 index values per each point scored on the scale). This finding links a personal understanding of shared ideas (representations of seafood) to individual eating behavior and a related physiological state, potentially contributing to reduced risk of morbidity and mortality. This emphasizes the importance of considering shared ideas and images of food and eating when distributing or discussing nutrition or health messaging related to contested foods.

Fish preparation confidence (models 2 and 6) was also associated with higher

reported fish intake. Fish preparation confidence was statistically significant in predicting fish intake in the S+B sample prior to adding social representations to the model; with a larger sample size, it may have remained statistically significant when considering social representations. However, both model 2 and 6 suggest that fish preparation skills may be a potential path for increasing fish consumption as higher fish preparation confidence scores predicted clinically relevant higher fish consumption (about 1.5 oz per week), enough to decrease mortality risk according to Lim's estimate (2013). Fish preparation confidence was also statistically significant in predicting omega-3 status, with a one point higher score on the scale predicting about a 0.3% increase in the index (model 12 and 13). This provides biological confirmation of the self-reported findings that those who have higher levels of preparation confidence have higher levels of fish intake. Fish preference was also statistically significant in predicting omega-3 status, with a one point higher score on the scale predicting a 0.46% increase in the value. Previous research has identified these factors, ability to prepare fish and taste preferences, as being associated with intake among other populations (Birch & Lawley, 2012; Hall & Amberg, 2013; Pieniak et al., 2008; Verbeke & Vackier, 2005; Olson, 2009).

The second hypothesis proposing a relationship between cooking method and omega-3 status was not supported by these data. This may be due to the semi-quantitative food frequency questionnaire, the imprecision of food frequency questionnaires, or the lack of controlling for other sources of fat in respondents diets. Alternatively, the amount of fish prepared in high fat forms may be too low to affect the omega-3 index. Previous research using larger samples, over 1,000 individuals, suggests that preparation method may affect omega-3 status (Mozaffarian et al., 2003), and future studies may benefit from more precise

dietary assessment methods and/or larger sample sizes than was possible in this project.

The clinical significance of the findings can be related to recommended fish intake and omega-3 index values: both were lower than recommended in this sample, suggesting a need for additional efforts in community and public health nutrition and clinical dietetics. The self-reported fish intake of this sample (7.1 oz/wk) was substantially higher than the 2015 national average (4.8 oz/wk) (Van Voorhees, 2015) but still below the 8 ounces recommended by the DGA (USDA, 2015). Similarly, the mean omega-3 value of this sample (4.8%) was slightly higher than a large American sample (4.5%) (Harris et al., 2013). While the mean value of the omega-3 index in the DBS sample was above the level marking highest risk, less than 4% (Harris & von Schacky, 2004), nearly all of the participants remained below the proposed ideal omega-3 index of 8%. This suggests that efforts to increase their EPA and DHA intake via improving the social representations of fish and seafood consumption could potentially offer health benefits to a substantial proportion of the midlife rural adults represented in this study.

This research aligns with previous research examining connections between health-related beliefs and fish and seafood intake. Most broadly, simply believing eating affects health may alter fish consumption: Norwegians who believed food is important for health were more likely to eat oily fish and lean fish (Trondsen, Braaten, Lund, & Eggen, 2004). Consumers also often report health as a motivation for eating fish (Brunso et al., 2009). A small amount of research also supports findings in this study, suggesting counseling and altering beliefs related to fish are a potential route to changing food choices. For example, one

intervention promoted a podcast about omega-3 fatty acids to grocery shoppers, finding their purchases of seafood increased (Bangia & Palmer-Keenan, 2014). Other research indicates that dietary counseling provided by RDNs was effective at increasing fish consumption within a larger intervention (Bihuniak et al., 2016).

Two potential intervention targets emerged from this data: social representations about the positive health effects of fish and seafood and fish preparation confidence. Changing social representations of the health effects of eating fish and seafood would be a low risk and low cost intervention that could be incorporated into public health campaigns and nutrition counseling as well as routine policy statements, including future dietary guidelines and messages about fishing and toxicology from national and state agencies. Clinicians and nutrition educators may find that shaping the discourse around fish to focus less on mercury and more on the benefits in terms of heart and brain health can contribute to strengthening the positive social representations of fish and seafood in their communities. On the national and policy levels, working to clarify messaging that promotes fish to healthy adults may enhance the positive social representations. Currently, messaging about seafood often focuses on contaminants, which may enhance negative social representations. For example, the guidelines for limiting tuna based on mercury during pregnancy decreased fish intake even among consumers not consuming levels above the recommendations (Oken et al., 2003). These concerns were also discussed by post-menopausal women and men, not targeted by the recommendations, in qualitative research about social representations of fish and seafood presented in Chapter 2. Enhancing positive social representations related to fish and seafood has the potential to improve dietary intake.

Confidence in selecting and preparing fish and seafood is another potential target that could be implemented by clinicians, health-related programming, and retail dietitians. Those conducting hands-on learning experiences, including the Extended Food and Nutrition Education Program, cooking classes, or grocery store tours, have an opportunity to contribute to the fish-related provisioning knowledge and confidence of household cooks through experiential learning and taste experiences. Developing workshops to highlight each step of the provisioning process, from acquisition to storing leftovers, could address some areas of consumer uncertainty.

This study has several notable strengths. First, it relates a biological measure to self-reported fish intake. As previously reported, intake of either fish or fish oil affects omega-3 status (Harris et al., 2007), and we are confirming the findings of this study. Furthermore, this study takes a step beyond existing knowledge by relating diet-related cognitive constructs, that is, personal understandings of social representations, to both food intake and a related biological measure. In addition, the research team specifically sought out venues for recruitment of a sample in which participant income, education, and attitudes toward fish were expected to vary.

Some sampling and measurement limitations may have affected the findings. First, this sample was drawn from a limited geographic area that is relatively homogeneous in terms of race and ethnicity, limiting the diversity of cultural fish and seafood eating practices and patterns. Second, this sample was approximately two-thirds women; a study including more men may have had different findings given that women have been found to have greater concern for nutrition-related behaviors perceived as healthful, for both individual food

choice and household shopping (Beardsworth et al., 2002; Nayga, 1997). Furthermore, other constraints limited DBS collections and may have introduced unobserved bias, such as interest in food or cooking, into the findings despite the similar participant characteristics of the two sub-sets in the sample. These aspects of the study sample limit the generalizability of the findings to broader populations, including those with wider racial, ethnic, cultural, geographic, and gender diversity. In addition, all data about behaviors and attitudes was collected via self-report; participants may have tailored their responses to their ideas of the researchers topic, neglected to answer certain questions, or experienced memory bias while completing the paper survey. Previous research has shown short dietary assessment tools like the one used here to measure fish intake to be effective at ranking fish and seafood intake among a sample but less valuable for assessing absolute intake (Oken et al., 2008). Both the limitations of the dietary assessment tool and the self-report nature of the survey data suggest that caution should be used in interpreting the quantities of fish intake beyond this study. However, neither is expected to add notable bias to the findings. While the level of missing data was generally low (fewer than 5% of cases were deleted in each regression due to missing data), there were higher levels of non-response for certain survey items in the scales, such as those towards the end of the survey.

Future research needs to expand these findings among more diverse populations and geographic areas, including validation of the scales with other adult populations. The concepts of fish-related social representations should be explored in more detail to assess how these shared ideas vary among different communities and the routes through which fish and seafood-related representations evolve. In addition, further work should explore the role of fish prepa-

ration confidence, including which elements are most important and how they are most effectively learned. Additional assessments of larger samples would provide greater knowledge about whether and which additional variables are related to fish and seafood consumption. Furthermore, research is needed to examine what type of health messaging can be used to alter social representations most efficiently, both in terms of fish and seafood as well as other topics.

4.5 Conclusions

Middle-aged adults from New York who scored higher on positive social representations of seafood reported consuming significantly more fish and seafood. In addition, in the sub-sample who participated the voluntary blood collection, those who scored higher on the positive social representations scale had significantly higher omega-3 values. However, no influence of preparation methods for fish and seafood on the omega-3 value was observed. Taste preferences for fish and seafood flavors and textures as well as confidence cooking fish were also associated with higher fish and seafood intake and higher omega-3 index values in some of the analysis.

CHAPTER 5

DISCUSSION

Curiosity motivated this project: how do rural Americans think about and manage fish consumption? Despite the simplicity of the question, it was a relatively unexplored topic and remains an area ripe for additional research, interventions, and system changes to support consumption. The two parts of the project, qualitative and quantitative, approached the topic in different ways in order to explore this question. The following chapter will integrate the findings from each chapter, discuss key strengths and limitations of the projects design, identify future areas of research suggested by this work, and consider both the theoretical and the practical implications of the findings.

5.1 Integrating the project findings

The findings across the segments of the project suggest that midlife adults were aware of various shared ideas and images about fish and seafood, as discussed in Chapter 2. While they may choose to interact with those shared ideas in different ways (as demonstrated by the differing patterns of involvement with the identified social representations), they were participating in the joint creation and evolution of socially constructed knowledge through their words, actions, and eating behaviors. The social representations they held were incorporated, in some cases, into the scripts for acquisition and eating out described in Chapter 3. Furthermore, midlife adults were affected by their personal interpretations of those social representations: those who scored higher on the positive social representation scale reported higher fish intake and also had higher omega-3

index values in the survey study reported in Chapter 4. Those who reported greater fish preparation confidence, in turn, were found to have higher fish and seafood consumption and omega-3 index values. Confidence with fish preparation may reflect ease in accessing and using cognitive scripts for managing fish and seafood consumption, such as those described in Chapter 3.

5.1.1 Social representations and scripts

Considering both social representations and scripts for different types of fish-related behaviors offers insight into how these ideas can shape actions. Examining these suggests potential connections between community-wide, shared knowledge and individual food choice knowledge and behaviors. Some participants' individual scripts, particularly for purchasing fish and seafood, included many of the positive and negative social representations from different domains (see Figure 2.1). Selecting low mercury tuna brands or seeking high omega-3 fish species, for example, were both examples of individually-held core social representations (avoiding "mercury" and seeking "omega-3") that had been incorporated into scripts. Other strategies incorporated into scripts based on social representations including selecting fish from certain areas (avoiding "pollution") or seeking a preferred production method (seeking "wild-caught").

5.1.2 Social representations and consumption

A small sub-set of possible social representations were found to be statistically significant in predicting fish intake in this project. The breadth of the core and

peripheral social representations described in Chapter 2 suggest a substantial number of topics may relate to fish and seafood provisioning choices. Only core health-related representations were evaluated, and only the positive social representations scale was significantly related to intake. Those who agreed more strongly with the positive social representations scale reported high fish and seafood intake and had higher omega-3 index values. Other domains of representations were not significantly related to fish intake or omega-3 status in this sample; they may be less relevant for intake, or the scales developed may not have been optimized for measuring the domains. The relationship between positive social representations and the omega-3 index persisted even when controlling for fish intake, suggesting subtle changes in behavior related to the omega-3 index, such as selecting substantially more high omega-3 fish species or other EPA and DHA supplemented foods and supplements (such as milk, breakfast cereal, or nutriceuticals). Alternatively, the omega-3 index measure may be a more precise and accurate indicator of fish intake than the semi-quantitative food frequency questions.

5.2 The project methods

Mixed methods approaches have certain advantages, including across method triangulation, developing multiple perspectives about a research question, and combining the strengths of each method selected (Tashakkori & Teddlie, 1998). Mixed methods also have disadvantages. Depth in one part of the project may be sacrificed for practical reasons (such as time, personnel, or financial constraints) or to include other parts of the project. There may be potential difficulty in integrating conflicting findings. Researchers may have more knowl-

edge, skill, and experience in some methods than in others. Qualitative research such as that used in this project offers an inductive perspective that prioritizes the lived experiences of those volunteering for the research study and promotes theory generation (Charmaz, 2006; Walker & Avant, 1995). This approach is particularly suitable for asking questions with the intention of discovering novel and nuanced material that cannot be observed, such as one's values and priorities (Charmaz, 2006). However, this qualitative approach is resource intensive and generalizability is typically very limited (Tashakkori & Teddlie, 1998). Quantitative research such as the survey used here offers a deductive perspective that approached a research question with an a priori hypothesis that can be tested (Kerlinger & Lee, 2000). One advantage is that quantitative findings may be more widely generalizable, depending on the study design (Kerlinger & Lee, 2000).

This project design was a sequential two-phase ("QUAL-quan") project (Tashakkori & Teddlie, 1998). The first phase was a more intensive qualitative study, using a constructivist approach to develop broad research questions, open-ended data collection procedures, and inductive analyses. The second phase was a quantitative study that expanded on those findings using a hypothesis driven research question, primarily closed-ended data collection procedures, and deductive analyses. The QUAL-quan approach was selected due to the relatively unexplored topic area, which was well-suited to an initial qualitative approach (Charmaz, 2006), and a desire to expand on those findings related to dietary outcomes. This integration of these two methods is illustrated by the research cycle presented by Tashakkori and Teddie (1998), with details of this project added to Figure 5.1. The qualitative phase collected data that was used to induce theory-based frameworks (the findings presented in Chapters

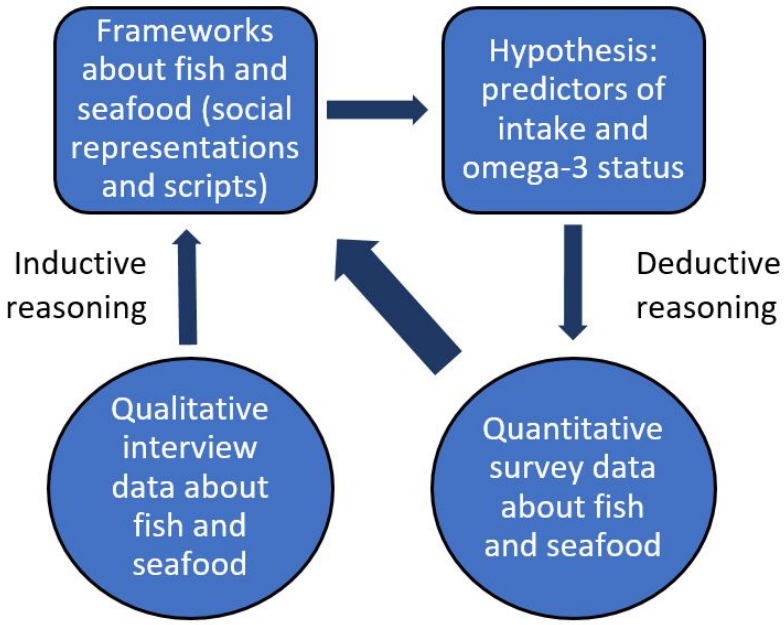


Figure 5.1: Integration of qualitative and quantitative data collection methods and analyses

2 and 3). Those frameworks then guided the development of hypotheses that shaped the quantitative data collection used in study two. Deductive reasoning was then used confirm or reject the hypotheses, which complemented the findings from the first, qualitative study.

5.2.1 Strengths

A particular strength of the project was the integration of methods: this research project used in-depth interviews, quantitative surveys, and a biological measure to explore concepts related to fish and seafood consumption. Using a mixed method approach in this project strengthened the conclusions by examining specific qualitative findings developed from individuals' perspectives using a quantitative survey in a larger sample than would be feasible for a qual-

itative project. The statistical analysis of the survey responses provided further evidence for the relevance of the social representations, developed through the interview portion of the project, as both being present and being relevant to food choice (specifically fish and seafood).

Other strengths of the study included recruitment through a wide range of groups, locations, and gatekeepers. While random sampling was not a goal of the first phase, a sample diverse in terms of selected characteristics and fish consumption frequency was recruited. These individuals provided widely differing experiences, insights, and opinions. Furthermore, recruitment continued to use a range of venues (with small numbers of individuals recruited from most venues) in order to describe a sample somewhat representative of the area's midlife rural adults.

One additional strength was the careful development of the research tools. The interview guide was reviewed by experienced qualitative interviewers and practiced before beginning the study, and then revised to add probes and questions about themes that emerged during earlier interviews. The survey combined materials used in previous studies with items currently relevant to this population, and was then pilot tested with demographically similar adults. Furthermore, the survey was administered in-person in order to encourage completeness and confirm participant eligibility.

5.2.2 Limitations

This project had some limitations. First, both studies in the project were cross-sectional evaluations that can only reflect findings at one time point. No ev-

idence about change or causal relationships can be determined from a cross-sectional assessment (Kerlinger & Lee, 2000). Second, the samples were from a limited geographic area: the Finger Lakes and Southern Tier regions of New York State. This not only limited the food environment that participants experienced but also limited the cultural, ethnic, and racial diversity of the samples. Third, while efforts were made to recruit lower income individuals, the participant demographics suggest that this sample was likely more educated and more financially comfortable than a representative sample of Americans. The core and peripheral social representation findings may be different among different social and class groups and the script types would likely be different among different cultural, ethnic, and racial groups in other geographic areas.

Measurement limitations also affected the project. While an audit trail, peer review, and double-coding were used to minimize bias introduced by the researcher during analysis of the qualitative data, the researcher's experiences, perspectives, and expectations may have altered the ways the interviews were conducted, transcribed, coded, analyzed, and interpreted. Similarly, measurement biases could have been introduced into the survey results, through designing the survey items or the process of data collection. The phrasing of some scale items may have been conducive to response biases of yeasaying and/or naysaying, or non-random errors. While the specific hypotheses were not shared with survey participants, the topic was described during recruitment and consent. Some degree of social response bias may have been introduced. Such a social response bias may have encouraged greater agreement with statements about health or healthy behaviors.

5.3 Future research

This project answered selected, narrow questions that open additional avenues of research. Novel perspectives from each theoretical approach were proposed using only small, cross-sectional samples in a limited geographic area. Going forward, there are a number of theoretical and practical aspects that would benefit from further examination.

Theoretical development

First, elements of the social representations-based analysis would benefit from further exploration and testing. The proposed patterns of involvement with social representations have only been identified in relation to one topic in one small sample. Finding those and perhaps additional patterns of involvement with social representations related to other food and eating topics, or topics in other fields, would support the theoretical finding of patterns of involvement with social representations. Furthermore, identifying additional patterns may enhance the robustness of future practical applications of the concept of social representations as related to individual behavior.

Second, the theoretical integration of social representations and scripts has the potential to lead to deeper understanding of thoughts and behavior. Social representations provide a contextual milieu that primes the formation and evolution of selected steps in scripts mediated by individual patterns of involvement. Research projects that examine social representations held by a social group and how those representations are incorporated into routine behaviors will provide

insight into the role of each in relation to different settings, groups, and topics. Both qualitative, in-depth research using interviews and observations in small samples and larger quantitative projects, such as surveys or analysis of media and consumer data, will be valuable for examining this phenomenon on different scales.

Third, the new concept of cognitive script integration was proposed in the inductive analysis. Food provisioning may be a somewhat unique activity, because in this case, the stages of acquisition, preparation, and eating may be separated by days with flexible planning. Other activities studied using a script-based analysis have typically been single bouts, such as going on one date (Mandler, 1984). In integrated scripts, in contrast, choices made in one script (acquisition) may constrain the selection of later scripts (preparation). Developing a deeper understanding of how script integration is experienced by individuals is necessary before applying this concept more broadly. Research studies using interviews, time use diaries, and other records of behavior choices and the thoughts behind them would be useful for determining if this phenomenon occurs in other groups in relation to other topics.

Future research for application

While this work suggests a need for more theoretical development, additional research would also strengthen the applied findings and their future applications in practice and policy settings. First, both sets of data were cross-sectional designs: conducting longitudinal studies is essential to developing stronger relationships between the concepts, including establishing temporality. Longitu-

dinal studies would be particularly useful in evaluating what may stimulate social representations to evolve over time in social groups and individuals, without intervention. Given this data, randomized controlled trials could be designed to begin to assess potential causal relationships between group social representations, individually-held representations and behaviors using those findings.

Bronfennbrenner's ecological model is one framework for guiding multilevel interventions, randomized or not (Bronfenbrenner, 1977). Microsystem-level interventions would involve actions taken at universities, workplaces, and healthcare sites, including community-based nutrition education efforts. Macrosystem-level interventions would involve media exposures (such as social media, paper materials, or film), changes in policy, and altering food systems (through working with local fisheries, grocers, food processors, or providers of institutional food services). Developing successful protocols for shifting social representations through adult education would potentially open an affordable approach for communicating health and nutrition guidelines in a way that encourages their adoption widely throughout a community. Working at multiple levels may exert a stronger influence on the exosystem, where social representations (beliefs of the culture) are embedded.

Similarly, developing an understanding of how script repertoires develop, expand, and contract throughout the contexts of the life course, including occupational, relationship, and geographic changes would be valuable for the creation of script-based nutrition education and interventions. Helping people develop scripts moves beyond simply offering knowledge by moving into practices. Longitudinal observational studies with biographical interviews using a vari-

ety of methods (such as time use diaries, food records, interviews, grocery store receipts, and cooking observations) to triangulate the findings could amass a body of data that follows food provisioning scripts and their shifts. Intervention studies would be useful for exploring how script formation can be influenced, including using experiential learning, counseling techniques, and peer-to-peer learning. More detailed research is also needed to develop an understanding of the breadth of script integration: how tightly are scripts connected to each other? How easily can one script be re-directed into another script? Learning how to replace script connections may be one route for supporting healthful substitutions, such as when someone learns to bake instead of fry cod.

Continuing both lines of applied research would make the theories more useful for practitioners: creating a knowledge base of how to use them in their practice settings, from individual counseling and community-based programming to state and national program design.

5.4 Implications and applications

The scope of this research project, from individual cognition and beliefs influenced by state and national policies to biological status, suggests immediate steps and practical implications that could be taken on a number of levels, from the individual to federal agencies and mass media. The following sections will discuss these using a micro level perspective, primarily focusing on clinical implications, before moving on to meso and macro level perspectives that incorporate relevant elements of community nutrition, public health programs, and infrastructure.

Individual Nutrition Education. Registered dietitian nutritionists (RDNs), licensed nutritionists (LNs), certified diabetes educators (CDEs), and registered diet technicians (DTRs), as well as other health professionals evaluating client and patient diet concerns are positioned to provide individual counseling that supports the promotion of positive social representations about fish and seafood. Counseling techniques such as motivational interviewing (Holli, Maillet, Beto, & Calabrese, 2009) can be used to establish current concerns related to fish and seafood as well as to then brainstorm potential actions feasible for the client. Sample probes for eliciting the fish-related social representations held by that individual include:

- How do you think people view eating fish?
- Tell me about how you feel about eating fish.
- What is an example of a concern you have about eating fish?
- Tell me about what encourages you to eat fish.

Discussing how they have come to hold those representations and providing additional representations may support clients in their efforts to increase fish and seafood consumption. For example, a client concerned about pollution could discover whether their concerns emerge from a certain region or exposure to recommendations targeting those who are pregnant. The positive social representations held the by individual could then be emphasized by the counselor, or additional information provided to amenable clients. Sample questions for determining feasible actions for the client include:

- What types of fish and seafood are you comfortable preparing?

- Tell me about when fish and seafood are easy for you eat.
- What are some challenges you have experienced when it comes to buying/preparing/eating fish?
- Tell me about the last time you bought/ate/prepared fish or seafood.

Beyond working to provide information about positive social representations in a manner that is easily understood and relevant to the client, a RDN can then help a client establish scripts for buying or eating fish and seafood. Walking the clients through the small details of how to select fish (What type of fish? Frozen/fresh/canned? Where can it be found in the grocery store? What is the client's price range? Is eating out more feasible than cooking?), the method they will use to prepare it, and how to store any leftovers will lay an initial path for the script. Setting SMART goals (goals that are Specific, Measurable, Achievable, Relevant, and Timely) (Barley & Lawson, 2016) is one way to begin taking steps toward practicing the script until it has become a well-known cognitive pathway. A sample SMART goal for a hypothetical client interested in eating salmon twice per week (current intake, 1-2/month) to improve adherence to a Mediterranean-style eating pattern is below:

SMART goal: I will bake frozen salmon with lemon and dill using the recipe from my favorite cooking show once a week (Tuesday or Wednesday) for the next three weeks.

1. Specific: Frozen salmon (type), bake (cooking method), recipe (details)
2. Measurable: One repetition is countable
3. Achievable: One repetition, using a familiar source for a recipe

4. Relevant: Fish is a key component of the Mediterranean diet.
5. Timely: A specific starting and ending window, frequency of behavior, and even days for making it.

Follow-up may be key for some clients: fish cookery is often perceived to be difficult, and questions may emerge as clients gain new experiences and clarify their scripts. Continued goal-setting may be needed to establish a set of scripts that are sufficiently resilient and flexible in order to adapt to changes in life circumstances, season, and other factors that affect food choice. The individuals in Chapter 3 who had more diverse scripts appeared to be more able to easily eat more fish often, suggesting that developing broad repertoire of scripts may benefit some individuals seeking to increase their fish and seafood intake. Those clients who are earlier in the process of incorporating fish and seafood into their diet will likely have longer follow-up time needs.

Another venue in which the individual could be targeted is culinary education. RDNs, chefs, university extension service agents, and others promote healthy cooking individually and in small groups. Those providing these programs could work to shift the set of social representations about fish and seafood by providing updated information about the health benefits to appropriate individuals. Furthermore, they are positioned to help individuals develop scripts, particularly for cooking fish and seafood. Providing experience-based learning would be a strong approach to encouraging the development of the knowledge, manual skills, and sensory skills needed to establish a script for cooking a new food or recipe.

Community and Public Health Nutrition. Public health nutritionists and dietitians specializing in community nutrition and public health could play a role in pro-

moting positive social representations of fish and seafood and fish and seafood scripts through their work. Careful evaluation of messaging related to fish and seafood prior to deploying them would be the first aspect they could influence in their scope of practice. This might include conducting cognitive testing of different potential messages to see how the audience understands them and then pilot testing final materials with social representation scales to evaluate the effect of the message on individually-held representations. In addition to creating new materials, incorporating fish and seafood into existing nutrition education programs and materials would be another way community and public health nutritionists could promote the adoption of fish and seafood-related scripts. For example, including a discussion of frozen fish quality and attributes on a grocery store tour would be one way to help those taking the tour prime their existing fish and seafood provisioning scripts, become more familiar with their fish and seafood options, or develop a proposed script to try in the future. This may be particularly important in rural areas, where fresh fish catches usually are not readily accessible in stores.

Specific considerations may be needed with different populations. One large, national nutrition education effort in the US, the Expanded Food and Nutrition Education Program (EFNEP), reaches low-income adults and has been shown to lead to behavior changes (USDA, 2016). EFNEP is a potential venue for providing fish and seafood-related education as a component of a healthy diet and food preparation skills; however, limited budgets constrain both what interactive programming can be provided during a lesson and later what those households can purchase with their food budget. Creativity, however, may increase the ability of the program to provide fish and seafood education. For example, a session could focus on lower cost but still higher omega-3 fish and seafood

options, including canned tuna and sardines or other locally affordable options (McGuire et al., 2016).

Fish and seafood, despite their placement in the DGA, are not prominent in community meals such as senior lunch due to cost (personal conversation, Trudy Radcliffe, Chenango County Office for the Aging). Conducting a community needs assessment would be another way to assess available resources, community preferences, and potential partners for interventions to improve intake of fish and seafood. Given their lack of durability, fish and seafood, with the exception of canned fish, are also not commonly distributed through food pantries (Gany et al., 2013). Finding ways to incorporate access to fish and seafood meals and food safety net programs would be one route for potentially increasing access for low-income and other vulnerable populations. Furthermore, making a variety of non-fried fish available to younger children still forming their tastes would model the use of acquisition, preparation, and/or eating scripts for fish and seafood, from childhood to old age. Supporting the formation of taste preferences may be one way to encourage consumption, based on the role of taste in these findings (Chapter 4) and previous work (Pieniak et al., 2008).

Media. Presentation of health guidelines by the media to the general public is a valuable service; however, the media also potentially exaggerates or misconstrues recommendations. This dissertation research found high levels of concern about mercury among a population (that is, not women of childbearing age) not targeted by EPA guidelines to limit tuna consumption. Placement of the population affected by the guidelines late in the news article or story, for example, may help promote confusion and negative social representations among the public. Similarly, coverage of positive health effects of eating fish may im-

prove social representations and prime the use of scripts for fish and seafood consumption. Educating journalists and other influential media personalities about how to evaluate and represent scientifically-based guidelines may support the promotion of positive social representation and, thus, fish and seafood consumption.

Policy. Food, nutrition, fish and wildlife, and environmental policy all converge in the information milieu contributing to the formation of fish and seafood-related social representations. The health benefits of omega-3 fatty acids, the regulation and monitoring of wild catch and aquaculture, and the cleanliness of water bodies contribute toward the source material influencing statements and guidelines about fish and seafood.

Currently, state and national recommendations for limiting fish consumption based on environmental toxicology err heavily on the side of protecting the most vulnerable: the smallest and youngest, fetuses and those under age two (Nesheim et al., 2007; *Technical Information on Development of Fish Consumption Advice - FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017). The most recently issued guidance for the public (*Questions and Answers from the FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017) did not emphasize the target population prior to peer review. Their answer to the question of whether the advice applies to those not pregnant, breastfeeding, or young children was that "lower mercury fish are a good choice for everyone" and "everyone can follow this advice" (*Questions and Answers from the FDA/EPA Advice on What Pregnant Women and Parents Should Know about Eating Fish*, 2017). These recommendations were shown to be entering the social representation sets of midlife adults over age 50, who are rarely

planning future childbirth or pregnancy, prior to issuing this new advice. It seems likely more adults will absorb the negative representation suggested by this advice which may affect fish consumption choices.

Several potential actions could help improve the targeting of these messages. First, policies should explicitly state those are not covered by warnings about fish (i.e. those at higher risk of psychiatric illnesses and cardiovascular disease). Second, the policies should define the risk of over-consumption clearly in a way that the public is able to comprehend (i.e. consuming ten shark meals per week is similar to decreasing exercise by "xx" minutes per week). Third, the guidelines should be disseminated in a focused manner rather than to the broader public. Screening for fish consumption among women in their 20s and 30s and among parents of young children would be a more targeted way to selectively discuss the risk and modify behavior among the few who exceed recommended levels. While the findings in Chapter 4 did not support a statistically significant relationship between negative social representations and fish and seafood intake, perhaps due to sample size or instrumentation, the scripts in Chapter 3 incorporated concerns about mercury and previous research supports the potential power of this type of widely publicized recommendation (Oken et al., 2003).

Food Systems Perspective. Food systems are networks that incorporate the many participants: producers, processors, consumers, policymakers, and those who provide related infrastructure (Sobal, Khan, & Bisogni, 1998). Considering how each player interacts with the others to create the food our society and communities consume is essential to any effort seeking change in diets. A suggestion to a client in nutrition counseling to try cooking a new type of frozen fish is irrel-

evant if their rural Nebraska grocery store fails to stock a variety of options, as was found in work by Folta (Folta et al., 2008). Creating a resilient, safe, accessible food supply in rural areas is an essential co-requisite to making it possible for midlife adults living there to close the gap between current intake and the recommendations in the DGA.

Finally, it is important to note that fish and seafood is one of the few remaining foods that are commonly eaten from the wild, whether caught in a neighborhood pond or middle of an ocean. Wild-caught fish and seafood are simultaneously alluring and yet potentially dangerous, with their characteristics of limited durability (Thompson & Cowan, 1995) and depletion of resources (Thilsted et al., 2016). As aquaculture has evolved, its production, marketing, packaging, taste (perceived or actual), access and affordability have shifted. "Farmed fish" are found in supermarkets and discount superstores in rural, urban, and suburban areas across the country even as exposes about production methods are distributed in mass media (Pfeiffer, 2016). However, aquaculture now provides half the fish and seafood consumed in the world, making it an important food source (Thilsted et al., 2016). Developing sustainable production systems that contribute to community, national, and world food security and health will provide the necessary supply for increased fish consumption and nutrient intake on individual, community, or societal levels. Suggestions include considering diversification of species, reduction of waste by using of catch by-products (colloquially described as trash fish), managing affordability of the product, protecting water and coastal resources, and developing systems that protect equity for small producers and labor (Thilsted et al., 2016).

The images, media coverage, and discussion of the health and ecological effects

of producing fish and seafood in capture fisheries support suspicions on the part of consumers even as aquaculture is evolving to support food production without depleting wild stocks. Considering the many shared images, not all of which were explored within the scope of this project, associated with wild-caught and farmed fish will be important for advancing understanding of elements of shared social representations and how consumers think about and evaluate fish and seafood in their fish provisioning scripts. Creating policies which support the development and spread of sustainable production methods that yield delicious affordable products may help support the development of positive social representations of aquaculture. From those shared ideas and images, individuals may develop the confidence to incorporate the foods into their scripts for fish and seafood provisioning, decreasing their risk of select health conditions.

5.5 Conclusion

Fish and seafood are an important food source for many people, culturally, socially, and nutritionally. Understanding how fish and seafood fit into the mental maps of communities and individuals through examining the social representations and scripts used by midlife rural adults provided insights into how fish and seafood are loved, feared, enjoyed, and disregarded. This simple food - a piece of fish - can simultaneously be an icon for a nuclear accident suggesting death and disability, a symbol of health and longevity, a key to community membership, and a sign of family love and routine meals. Understanding these many images and ideas about fish and seafood may help improve understanding of why Americans do not eat recommended amounts of fish and seafood

and how this gap can be narrowed.

APPENDIX A

QUALITATIVE INTERVIEW GUIDE

INDIVIDUAL INTERVIEW GUIDE Fish and Seafood Provisioning: the Experiences of Midlife Adults

Eating and preparing fish

- Whats your favorite meal with fish or shellfish?
- Tell me about the last time you ate fish or shellfish.
- How do you usually eat fish or shellfish at home? *Probe for: detailed description of the preparation methods, the circumstances (social setting, physical setting, timing, accompanying foods, etc.)*
- How do you like to make fish at home? *Probe for: preparation methods*
- What are some other ways your make fish or shellfish at home?
- Please share how you learned to make "—".
- How do you usually eat fish or shellfish when you are eating out? *Probe for: detailed description of the preparation methods, the circumstances (social setting, physical setting, timing, accompanying foods, etc.)*
- Tell me about eating fish when you are traveling, for work or vacation.

Buying fish

- Tell me about your experiences buying fish and shellfish. *Probe for: availability, perceptions of price, quality concerns, type bought, reasons for choices, examples*

- What else do you consider when you are buying fish?

Reasons for eating fish

- So it sounds like you eat fish and shellfish because "—". What are some other reasons you eat fish?
- Help me understand which reasons are most important in your decisions to eat fish.
- What helps make it easy for you to eat fish?
- What make it hard for you to eat fish?
- How does eating fish and shellfish fit in your usual routines?
- What are some examples of when you avoid eating fish and shellfish? Why?
- Tell me about your experiences with eating fish in your childhood.
- How has traveling or living in other places changed how you feel about eating fish and seafood?

Supplement use

- Do you take any supplements? If so, what?
- What are your reasons for taking "—"?
- How did you hear about these supplements?

Discourses about fish

- What do you hear about fish? In the media? From friends/family/neighbors?
- How has hearing "—" changed your fish eating habits?
- What do you believe about the health benefits of eating fish?
- What do you believe about the health risks of eating fish?
- Tell me about your best experiences with fish.
- Please share your worst experiences with fish.

Concluding questions

- It sounds like you have "—" at home. Can you think of anything else?
- In general, it sounds like you consider "—" when you are thinking about getting fish (at a restaurant/in a store). Is there anything else you consider?
- What else would you like to say about fish and seafood?

APPENDIX B

QUALITATIVE STUDY: SAMPLING FRAME

A sampling frame was developed based on participant characteristics expected to influence food choice, including fish and seafood-related experiences. A single participant was able to fulfill multiple criteria (such as someone working full-time living alone). The following table specifies the minimum target of each participant characteristic followed by the participant characteristics of the sample.

Table B.1: Qualitative Sampling Frame

Participant characteristic	*Minimum n*	*Actual n*
Male	5	11
Lives alone	2	11
Lives with others	5	20
Eats fish rarely	5	4
Eats fish often	5	5
Works full time	3	12
Retired	3	11
Lives in Seneca County	8	12
Lives in Schuyler County	8	11
Lives in Chenango County	8	8

APPENDIX C

SURVEY

The nine page survey is inserted on the following pages at 90% of the original size. The survey was administered printed on paper, double-spaced, and stapled.

Fish & Seafood Survey

This survey asks about your views and your experiences with eating, buying, and preparing fish and seafood. There are no penalties for not completing the survey, and you may stop at any point. If you have any questions about the survey, you can contact Stephanie Bostic at smb482@cornell.edu or 607-255-3435.

Please provide some information about yourself. Write in the answer in the box or place a mark [x] next to the answer that closest matches your experiences.

1. How old are you?

[ ][ ] Years

2. Are you:

[ ] Male [ ] Female [ ] Other

3. Who do you live with?

[ ] Live alone [ ] Live with spouse [ ] Live with other family

[ ] Live with other (please list): _____

4. What is the highest level of education you have completed?

[ ] Some middle or high school [ ] College graduate (2 or 4 years)

[ ] High school graduate or GED [ ] Graduate or professional degree

5. What is your race or ethnicity?

6. What county do you live in?

[ ] Cayuga [ ] Schuyler [ ] Tompkins

[ ] Chenango [ ] Seneca [ ] Yates

[ ] Cortland [ ] Other: _____

7. Are you currently:

[ ] Employed full-time [ ] Homemaker [ ] Unemployed

[ ] Employed part-time [ ] Retired [ ] Other:_____

8. Which best describes your current money situation?

[ ] Comfortable with extras [ ] Have to cut back [ ] Prefer not to say

[ ] Comfortable, no extras [ ] Cannot make ends meet

Survey number:

9. Who does more of the cooking in your household?

[ ] I cook more [ ] Another person cooks more

10. Are you or another member of your household allergic to any fish like haddock, tuna, or salmon?

[ ] I am [ ] A household member is [ ] No allergies

11. Are you or another member of your household allergic to any seafood or shellfish like clams, shrimp, or lobster?

[ ] I am [ ] A household member is [ ] No allergies

This section asks about what kinds of fish and seafood you have eaten recently, how it was prepared, and what types of oil and fat you usually eat. Three ounces of fish is approximately the size of a thin checkbook, or the palm of your hand.

12. In the past three months, how often have you eaten a serving (3-4 oz) of canned tuna fish?

[ ] Less than one serving per month

[ ] 1-3 servings per month

[ ] 1-2 servings per week

[ ] 3-5 servings per week

[ ] 6 or more servings per week

13. In the past three months, how often have you eaten a serving (3-4 oz) of shrimp, lobster, scallops, or clams?

[ ] Less than one serving per month

[ ] 1-3 servings per month

[ ] 1-2 servings per week

[ ] 3-5 servings per week

[ ] 6 or more servings per week

14. In the past three months, how often have you eaten a serving (3-5 oz) of dark meat fish like mackerel, salmon, sardines, bluefish, or swordfish? (Do not include canned tuna.)

[ ] Less than one serving per month

[ ] 1-3 servings per month

[ ] 1-2 servings per week

[ ] 3-5 servings per week

[ ] 6 or more servings per week

Survey number:

15. In the past three months, how often have you eaten a serving (3-5 oz) of other fish like cod, haddock, or perch?

[ ] Less than one serving per month
[ ] 1-3 servings per month
[ ] 1-2 servings per week
[ ] 3-5 servings per week
[ ] 6 or more servings per week

16. How often do you eat fish and seafood caught by yourself, a family member, or friend?

[ ] Less than one serving per month
[ ] 1-3 servings per month
[ ] 1-2 servings per week
[ ] 3-5 servings per week
[ ] 6 or more servings per week

17. How often do you eat fish and seafood AT HOME?

[ ] Less than one serving per month
[ ] 1-3 servings per month
[ ] 1-2 servings per week
[ ] 3-5 servings per week
[ ] 6 or more servings per week

18. How often do you eat fish and seafood AT RESTAURANTS (including take-out and fast food)?

[ ] Less than one serving per month
[ ] 1-3 servings per month
[ ] 1-2 servings per week
[ ] 3-5 servings per week
[ ] 6 or more servings per week

19. How often do you eat fish and seafood in OTHER LOCATIONS?

[ ] Less than one serving per month
[ ] 1-3 servings per month
[ ] 1-2 servings per week
[ ] 3-5 servings per week
[ ] 6 or more servings per week

Survey number:

20. Please list the other locations you ate at from question 19:

21. In the past year, how often did you eat deep fried fish and seafood (battered or breaded, including frozen fish and fish sandwiches)?

[ ] Less than six servings per year
[ ] 6-12 servings per year
[ ] 2-3 servings per month
[ ] 1-2 servings per week
[ ] 3 or more servings per week

22. In the past year, how often did you eat steamed, boiled, or poached fish and seafood?

[ ] Less than six servings per year
[ ] 6-12 servings per year
[ ] 2-3 servings per month
[ ] 1-2 servings per week
[ ] 3 or more servings per week

23. In the past year, how often did you eat baked, broiled or grilled fish and seafood?

[ ] Less than six servings per year
[ ] 6-12 servings per year
[ ] 2-3 servings per month
[ ] 1-2 servings per week
[ ] 3 or more servings per week

24. In the past year, how often did you eat pan-fried, sautéed, or stir-fried fish or seafood?

[ ] Less than six servings per year
[ ] 6-12 servings per year
[ ] 2-3 servings per month
[ ] 1-2 servings per week
[ ] 3 or more servings per week

Survey number:

25. In the past year, how often did you eat fish or seafood salad prepared with mayonnaise like tuna salad or shrimp salad?

[ ] Less than six servings per year

[ ] 6-12 servings per year

[ ] 2-3 servings per month

[ ] 1-2 servings per week

[ ] 3 or more servings per week

26. In the past year, how often did you eat homemade or prepared fish and seafood soups or chowders?

[ ] Less than six servings per year

[ ] 6-12 servings per year

[ ] 2-3 servings per month

[ ] 1-2 servings per week

[ ] 3 or more servings per week

27. In a year, how often did you eat fish and seafood casseroles, loaves, or patties?

[ ] Less than six servings per year

[ ] 6-12 servings per year

[ ] 2-3 servings per month

[ ] 1-2 servings per week

[ ] 3 or more servings per week

28. In a year, how often did you eat fish and seafood prepared in other ways not listed in questions 21-27?

[ ] Less than six servings per year

[ ] 6-12 servings per year

[ ] 2-3 servings per month

[ ] 1-2 servings per week

[ ] 3 or more servings per week

29. Please list the ways your fish and seafood were prepared in question 28:

30. How often do you use stick or tub margarine, in any foods?

[ ] Often [ ] Sometimes [ ] Rarely [ ] Never

Survey number:

31. How often do you use butter, in any foods?

[ ] Often [ ] Sometimes [ ] Rarely [ ] Never

32. How often do you use olive oil, in any foods?

[ ] Often [ ] Sometimes [ ] Rarely [ ] Never

33. How often do you use canola oil, in any foods?

[ ] Often [ ] Sometimes [ ] Rarely [ ] Never

34. How often do you use vegetable oil, in any foods?

[ ] Often [ ] Sometimes [ ] Rarely [ ] Never

This section asks about things you might consider when preparing or selecting fish. Please indicate how strongly you agree or disagree with the statement by circling one number.

		strongly disagree	disagree	neutral	agree	strongly agree
35	I know how to prepare many kinds of fish and seafood.	1	2	3	4	5
36	I could easily cook a new type of fish or seafood.	1	2	3	4	5
37	I generally select fish and seafood that I'm familiar with and have cooked before.	1	2	3	4	5
38	I do not feel confident when it comes to cooking fish and seafood.	1	2	3	4	5
39	I know how to use different cooking methods to fix fish and seafood.	1	2	3	4	5
40	Fish and seafood are easy weeknight meals to make.	1	2	3	4	5
41	I like fish and seafood dishes from different countries.	1	2	3	4	5
42	I don't trust new types of fish and seafood.	1	2	3	4	5
43	I am afraid to eat fish and seafood dishes I have never had before.	1	2	3	4	5
44	I will eat almost any fish and seafood dish.	1	2	3	4	5
45	Other people like to eat fish and seafood a lot more than I do.	1	2	3	4	5
46	I only like fish and seafood when it is fixed one or two ways.	1	2	3	4	5
		strongly disagree	disagree	neutral	agree	strongly agree

Survey number:

		strongly disagree	disagree	neutral	agree	strongly agree
47	The price does not stop me from buying the fish and seafood I want to eat.	1	2	3	4	5
48	Fish and seafood are too expensive for me to buy regularly.	1	2	3	4	5

Please state where you usually buy most of your fish and seafood by writing in the box.

49. Where do you buy fresh fish and seafood? Please list the store name(s).

50. Where do you buy frozen fish and seafood? Please list the store name(s).

51. Where do you buy canned fish and seafood? Please list the store name(s).

This section asks about your thoughts on fish and seafood and health. Please estimate how strongly you agree or disagree with the statement by circling the number.

		strongly disagree	disagree	neutral	agree	strongly agree
52	I don't think omega-three fats are helpful enough to risk eating fish and seafood.	1	2	3	4	5
53	I ignore what they say about fish and seafood being polluted.	1	2	3	4	5
54	Fish and seafood are healthier than beef.	1	2	3	4	5
55	I worry about pollutants in fish and seafood causing health problems for me in the future.	1	2	3	4	5
56	The omega-three fats in fish and seafood are very important to me.	1	2	3	4	5
57	I am concerned that fish and seafood may come from polluted waters.	1	2	3	4	5

Survey number:

		strongly disagree	disagree	neutral	agree	strongly agree
58	Eating fish helps reduce the risk of heart disease.	1	2	3	4	5
59	Eating fish and seafood will not harm your health.	1	2	3	4	5
60	I don't think the amount of mercury in fish would cause me any harm.	1	2	3	4	5

This section asks about buying fish and seafood. Please indicate how strongly you agree or disagree with the statement by circling the number.

		strongly disagree	disagree	neutral	agree	strongly agree
61	Where fish and seafood are caught is very important to me.	1	2	3	4	5
62	I am concerned that grocery stores and restaurants mislabel fish and seafood.	1	2	3	4	5
63	I think stores will only sell you fish and seafood that is safe to eat.	1	2	3	4	5
64	I trust government agencies to regulate fish and seafood safety for consumers.	1	2	3	4	5
65	I think the quality of fish and seafood is poor in many stores.	1	2	3	4	5
66	Fish and seafood are readily available in the stores around here.	1	2	3	4	5
67	Fresh, frozen, and canned fish and seafood are all readily available in my town.	1	2	3	4	5
68	The local grocery store has all the fish and seafood I like to eat.	1	2	3	4	5
69	I have to drive to another county to get good fish and seafood.	1	2	3	4	5
70	I think the fresh fish and seafood at the local grocery store isn't really fresh enough.	1	2	3	4	5
71	I can easily get the fish and seafood I want to eat.	1	2	3	4	5

Survey number:

72. What other comments do you have about fish and seafood?

Thank you for filling out the survey.

Survey number:

APPENDIX D

SURVEY DEVELOPMENT

D.1 Scale construction.

A pool of items was assembled from in-depth interviews about fish and seafood provisioning and health with 31 demographically similar participants in 2014-2015. Additional items were pulled from surveys in published journal articles, unpublished theses, previous surveys conducted within the lab about fish and seafood, and known scales that were adapted to this topic. The item pool was reviewed by the first author for clarity and duplication. Items that did not translate well (i.e. culturally or linguistically) or were overly repetitive were removed to shorten the pool into a feasible number. Selected items with repeating topics were kept in order to test which item was more successful. Two experienced survey researchers reviewed the selected pool of items for face validity. Revisions were made to selected items and pilot testing was begun after review by the university's institutional review board. Final items assessing specific constructs of interest were selected based on their appropriateness for this sample after eight pilot tests. These items are listed in the following table.

Two additional participants pilot tested the final version, leading to a total of ten volunteers with similar demographic characteristics to the study population testing two versions. The final survey was reviewed by one additional experienced researcher for face validity. Final scale items were included based on internal consistency in the full sample.

Table D.1: Scale Development

Scale	External sources	Items on pilot survey	Items in final scale
Fish preparation confidence	Birch and Lawley; Leek et al.; Hall and Amberg	8	5
Positive social representations	Hall and Amberg; Weinstein; Leek et al.	15	4
Negative social representations	Hall and Amberg	16	4
Fish preference	Thorsdottir et al.; Pliner; Leek et al.	12	6
Fish availability	Interviews only	8	7
Trust in food system	Interviews only	6	2

Table D.2: Scale Items

Fish preparation confidence	I know how to prepare many kinds of fish and seafood. I could easily cook a new type of fish or seafood. I do not feel confident when it comes to cooking fish and seafood (R). I know how to use different cooking methods to fix fish and seafood. Fish and seafood are easy weeknight meals to make.
Positive social representations	Fish and seafood are healthier than beef. The omega-three fats in fish are very important to me. Eating fish helps reduce the risk of heart disease. Eating fish and seafood will not harm your health.
Negative social representations	I don't think the amount of mercury in fish would cause me any harm (R). I am concerned that fish and seafood may come from polluted waters. I worry about pollutants in fish and seafood causing health problems for me in the future. I ignore what they say about fish and seafood being polluted (R).
Fish preference	I like fish and seafood dishes from different countries. I don't trust new types of fish and seafood (R). I am afraid to eat fish and seafood dishes I have never had before (R). I will eat almost any fish and seafood dish. Other people like to eat fish and seafood a lot more than I do (R). I only like fish and seafood when it is fixed one or two ways (R).
Fish availability	I think the quality of fish and seafood is poor in many stores (R). Fish and seafood are readily available in the stores around here. Fresh, frozen, and canned fish and seafood are all readily available in my town. The local grocery store has all the fish and seafood I like to eat. I have to drive to another county to get good fish and seafood (R). I think the fresh fish and seafood at the local grocery store isn't really fresh enough (R). I can easily get the fish and seafood I want to eat
Trust in system	I think stores will only sell you fish and seafood that is safe to eat. I trust government agencies to regulate fish and seafood safety for consumers.

All items followed by an R were reverse scored.

APPENDIX E

TABLES WITH CORRELATION COEFFICIENTS

Correlation coefficients between variables of interest are presented below. Those with p-values less than 0.05 are marked with an asterisk. Selected variables are abbreviated in the table headers. They are listed below.

Abbreviations:

Edu. = Education

Prep. Conf. = Preparation confidence

Pos. SR = Positive social representations

Neg. SR = Negative social representations

Trust = Trust in system

Pref. = Fish preferences

Availability = Fish availability

Intake = Fish intake

Table E.1: Correlation Coefficients for All Survey Participants

	Gender	Age	Edu.	Prep. Conf.	Pos. SR	Neg. SR	Trust	Pref.	Availability	Intake
Gender	1.0	0.04	0.07	-0.03	-0.01	-0.02	-0.02	0.09	-0.01	0.12
Age		1.0	0.11	0.08	0.05	-0.07	0.07	0.05	-0.02	0.10
Education			1.0	0.10	0.20*	0.02	-0.07	0.18*	0.01	0.12
Fish preparation confidence				1.0	0.39*	-0.04	0.05	0.46*	-0.04	0.21*
Positive social representations					1.0	-0.05	0.17	0.25*	0.10	0.24*
Negative social representations						1.0	-0.39*	-0.10	-0.07	-0.08
Trust in system							1.0	0.8	0.13	0.14*
Fish preferences								1.0	-0.07	0.18*
Fish availability									1.0	-0.05
Fish intake										1.0

Coefficients marked to indicate significance: *$p<0.05$

Table E.2: Correlation Coefficients in Adults who Provided a Blood Sample

	Gender	Age	Edu.	Prep. Conf.	Pos. SR	Neg. SR	Trust	Pref.	Availability	Intake	Omega-3
Gender	1.0	0.01	0.12	-0.10	-0.07	0.05	0.05	0.09	0.03	0.21	0.12
Age		1.0	0.17	0.12	0.06	0.01	0.09	0.12	0.01	0.07	0.18
Edu.			1.0	0.13	0.32*	-0.10	-0.11	0.24*	0.07	0.21*	0.16
Prep. Conf.				1.0	0.42*	-0.10	0.09	0.42*	0.12	0.23*	0.06
Pos. SR					1.0	-0.01	0.11	0.26*	0.13	0.23*	0.35*
Neg. SR						1.0	-0.21*	-0.3	-0.12	0.04	-0.03
Trust							1.0	-0.13	0.08	0.10	-0.027
Pref.								1.0	-0.06	0.24*	0.33*
Availability									1.0	0.01	0.06
Fish intake										1.0	0.25*

Coefficients marked to indicate significance: *$p<0.05$

APPENDIX F

REGRESSION COEFFICIENT TABLES WITH STANDARD ERRORS

Regression coefficients with standard errors from all 13 stepwise linear regressions discussed in Chapter 4 are presented on the following pages.

Table F.1: Predictors of Fish Intake in Ounces per Week among Midlife Rural New York Adults

	Model 1	*Model 2*	*Model 3*	*Model 4*
n = 208	204	203	203	200
Intercept	-0.43±4.73	-3.94±4.78	-6.58±5.55	-9.03±6.44
Age	0.07±0.07	0.07±0.07	0.06±0.07	0.05±0.07
Gender, female	-1.53±0.99	-1.65±0.98	-1.65±0.97	-1.39±0.98
Financial status, other than comfortable	1.77±1.11	1.75±01.09	2.28±1.10*	2.28±1.11*
Education	1.12±0.57*	0.89±0.56	0.71±0.56	0.86±0.57
Fish preparation confidence	-	1.46±0.49**	0.95±0.52	0.76±0.58
Positive social representations	-	-	1.90±0.75*	1.67±0.76*
Negative social representations	-	-	-0.58±0.60	-0.23±0.64
Trust in system	-	-	-	0.91±0.57
Fish preferences	-	-	-	0.57±0.64
Fish availability	-	-	-	-0.64±0.63

Beta coefficients ± standard errors marked to indicate significance: *p<0.05; **p<0.01; ***p<0.001.

Table F.2: Predictors of Fish Intake in Ounces per Week among Midlife Rural New York Adults who Provided a DBS

	Model 5	*Model 6*	*Model 7*	*Model 8*
n = 100	100	99	99	99
Intercept	-0.12±6.4	-3.14±6.45	-8.77±7.54	-15.65±8.95
Age	0.04±0.09	0.03±0.09	0.03±0.09	0.01±0.09
Gender, female	-2.42±1.49	-2.82±1.48	-2.80±1.48	-2.12±1.51
Financial status, other than comfortable	1.83±1.56	1.62±1.55	2.15±1.60	3.07±1.66
Education	1.70±0.80*	1.40±0.79	1.23±0.80	1.50±0.84
Fish preparation confidence	-	1.59±0.70*	1.15±0.78	0.59±0.85
Positive social representations	-	-	1.38±0.98	1.44±0.98
Negative social representations	-	-	0.51±0.88	0.79±0.90
Trust in system	-	-	-	1.50±0.88
Fish preferences	-	-	-	1.16±0.89
Fish availability	-	-	-	-0.41±0.86

Beta coefficients ± standard errors marked with significance: *p<0.05; **p<0.01; ***p<0.001.

Table F.3: Predictors of the Omega-3 Index among Midlife Rural New York Adults who Provided a DBS

	Model 9	*Model 10*	*Model 11*	*Model 12*	*Model 13*
n = 100	99	98	98	98	98
Intercept	3.49±1.12	3.45±1.16**	2.05±1.30	1.20±1.50	1.69±1.53
Age	0.02±0.02	0.02±0.02	0.02±0.02	0.03±0.02	0.02±0.02
Gender, female	-0.36±0.26	-0.38±0.27	-0.40±0.25	-0.32±0.25	-0.32±0.25
Financial status, other than comfortable	-0.36±0.26	-0.40±0.28	-0.17±0.27	-0.18±0.28	-0.20±0.28
Education	0.05±0.13	0.05±0.14	0.05±0.14	-0.12±0.14	-0.18±0.14
Fish preparation confidence	-	0.06±0.13	-0.15±0.13	-0.32±0.14	-0.35±0.14
Positive social representations	-	-	0.59±0.17***	0.56±0.16***	0.52±0.16**
Negative social representations	-	-	-0.07±0.15	-0.08±0.15	-0.12±0.15
Trust in system	-	-	-	-0.05±0.14	0.14±0.15
Fish preferences	-	-	-	0.47±0.14**	0.46±0.15**
Fish availability	-	-	-	0.11±0.14	0.15±0.15
Fish intake	-	-	-	-	0.01±0.02
High fat preparation	-	-	-	-	0.08±0.06
Low fat preparation	-	-	-	-	0.04±0.05

Beta coefficients ± standard errors marked to indicate significance: *p<0.05; **p<0.01; ***p<0.001.

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